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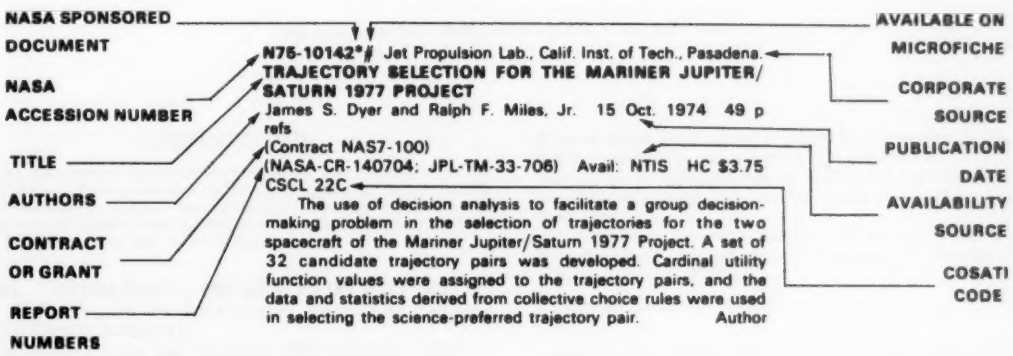
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N75-10142*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRAJECTORY SELECTION FOR THE MARINER JUPITER/ SATURN 1977 PROJECT
James S. Dyer and Ralph F. Miles, Jr. 15 Oct. 1974 49 p refs
(Contract NAS7-100)
(NASA-CR-140704; JPL-TM-33-706) Avail: NTIS HC $3.75
CSCL 22C
The use of decision analysis to facilitate a group decision-making problem in the selection of trajectories for the two spacecraft of the Mariner Jupiter/Saturn 1977 Project. A set of 32 candidate trajectory pairs was developed. Cardinal utility function values were assigned to the trajectory pairs, and the data and statistics derived from collective choice rules were used in selecting the science-preferred trajectory pair. Author

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power: Aircraft Stability and Control; and Research And Support Facilities (air). For Related Information See Also Astronautics.

1.0001, OPERATIONAL INFLUENCES ON RELIABILITY
G.A. KERN, Hughes Aircraft Company, *Culver City, California* 90230 (F30602-74-C-0221)

In virtually every case examined, field reliability values for avionics differ significantly from their predicted and 'demonstrated' values. The purpose of this program in the investigation of the relationships between reliability prediction/'demonstration' results and attained field reliability results for Air Force avionics. The study will identify those variables which most critically affect differences and develop models capable of equating reliability prediction/'demonstration' results to field attained reliability values.

Data on predicted, demonstrated and field attained values of reliability will be collected from a sufficiently large group of avionics. This information will be supplemented by an in-depth examination and analysis of data factors pertinent to avionics operation and maintenance which equate, for example, total operating hours to flight hours, and correlated separately and in combination, and a model defining field attained reliability as a function of predicted/demonstrated reliability (and other deterministic variables and constants as appropriate) will be developed.

Supporting agency address information: Rome Air Development Center RBR, Griffiss AFB, N.Y. 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0002, STUDY OF AIR TRAFFIC CONTROL SYSTEM CAPACITY AND DEMAND
R. RATNER, Stanford Research Institute, *Menlo Park, California* 94025 (014669 (TRAIS NO.))

A practical method of measuring air traffic control in terms of capacity and demand is being produced. Capacity limitations of operating strategies, separation mimima, safety aspects, controller workload, etc., are being measured. A conceptual design has been formulated for a family of computer based models.

Document provided to S.S.I.E. by the T.R.A.I.S.

SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

1.0003, NOISE RESEARCH PROGRAM
R.S. GALES, U.S. Navy, Biosystems Research Department, *San Diego, California* 92132

To review the current Navy R&D program in airborne noise and ientify additional requirements of the CMN R&D program to meet federal environmental noise regulations.

Present Navy R&D programs in airborne noise of the Systems Commands and other agencies will be reviewed by direct contact with cognizant personnel and review of relevant documents in order to identify all efforts related to environmental noise. This will include sources of noise on ships, aircraft, and ground installations and problem areas of hearing hazard, speech interference and general habitability and comfort. The current Federal Noise Regulations as promulgated by the Occupational Safety and Health Act (OHSA) and the Federal Noise Control Act of 1972 administered by EPA will be considered and recommmendations for needed program additions will be presented.

Supporting agency address information: Naval Supply Systems Command, Research & Development Division (01A1), Washington, D.C. 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0004, LOW COST EJECTOR RAMJET MIXING STUDIES
J. BENDOT, C C I Aerospace Corporation, *Van Nuys, California* 91409 (F33615-73-C-4093)

AF function - low cost air-breathing propulsion. Deficiency - high specific fuel consumption of low cost ramjet engines. Research - measurement of the mixing and diffusion properties of hypermixing ejectors under the influence of a high subsonic secondary. How research contributes - successful demonstration of improved mixing and diffusion characteristics would reduce the number of required injection nozzles. Such an improvement would reduce both engine weight and internal drag losses. More efficient rapid mixing would also shorten engine lengths to further reduce weight and provide better pumping characteristics of the engine to improve specific fuel consumption. Improved mixing characteristics would have spin-offs in other areas of air-breathing propulsion such as combustion efficiency.

An initial study will be made on three distinct cycles to determine the optimum system for this application. They are - (1) fuel-oxidizer addition, (2) fuel addition (simultaneous, mix and burn), and (3) fuel addition (diffuse, mix and burn). Studies will be made to select the proper fuel and oxidizer (if required). The purpose is to produce higher thrust levels than the standard ramjet cycle at the same specific propellant consumption.

Supporting agency address information: Aerospace Research Laboratory LE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0005, AIR TRANSPORT SYSTEMS ANALYSIS
A.A. LESHANE, United Aircraft Corporation, *Hartford, Connecticut* 06118

The current program is a broad-based effort aimed at all phases of air transportation, military and commercial. An underlying theme behind the program is the development and utilization of analytical models which are representative of ever-increasingly comprehensive segments of the air transport system. Based on established models which are capable of analyzing transportation systems from both user and operator viewpoints, current modeling efforts are aimed at accomodating the public viewpoint (energy, emissions, noise and congestion concerns) as well. This third viewpoint utilizes an innovative fractional benefit/cost analysis capable of combining benefits and costs not expressible in common units. Specific studies utilizing these models include a comprehensive comparison of U.S. domestic intercity transportation modes (including auto, bus, rail, air carrier, and general aviation), a comparison of alternative short-haul travel modes (including alternative air systems), and an evaluation of alternative options for reducing the energy consumption of commercial air transports. Recent work has examined the potential capacity

of the present U.S. domestic airport system through 1900, the effect of powerplant cycles and design and operational procedures for reducing the fuel consumption of military and commercial aircraft, and the potential of innovative air cargo concepts.

SUPPORTED BY United Aircraft Corp. - E. Hartford, Conn.

1.0006, FLASH FIRES
J. COMEFORD, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234

A laboratory scale flash fire cell is used to pyrolyze samples in air and measure the time of ignition with a high-voltage source to produce a flash fire. The cell is intended to allow monitoring of O2, combustibles, rate of heating of sample, and its temperature, permitting measurement of variables which may determine the propensity of a material to produce a flash fire.

Objective: The primary objectives of the first phase of this program are to develop a laboratory scale method for measurement of flash fire potential of aircraft interior materials and to use this method to evaluate important variables such as rate of heating and pyrolysis temperature on the production of flash fires.

Motivation: Flash fires are an important threat to life in aircraft cabins and building compartments. The FAA has requested NBS to undertake a program to develop methods of control for this major hazard. A basic understanding of the development of flash fires should lead to useful measurement techniques to evaluate flash fire potential of material.

Approach: A laboratory flash fire cell is used to pyrolyze samples of typical materials in air and measure time of ignition with a high- voltage arc to produce a flash fire. Instrumentation allows continuous measurement of oxygen, sample temperature, and pyrolysis furnace temperature.

Measurement: The measurements of rates of evolution of total combustible gas using catalytic detectors have been made and are being correlated with type of polymer. The potential for flash fire occurrence is being correlated with flammability limits for gas-air mixtures based on the combustion energy content of the pyrolysis gases. The cell performance has been improved using furnace temperature control and oxygen concentration is continuously measured.

SUPPORTED BY U.S. Dept. of Commerce - N.B.S.

1.0007, ANALYSIS OF HIGH POWER COMPOSITE ENGINE PERFORMANCE
R.D. BUHLER, Univ. Stuttgart, *Stuttgart, Federal Republic of Germany* (DAER075G001)

The proposed aerothermochemical analysis considers composite propulsion systems combining rocket and airbreathing components for special missions with greatly changing flight conditions, high acceleration requirements and/or V/STOL capability.

The performance capabilities of selected system configurations of this group are to be compared for simplified prototype mission-profiles on the basis of the aerothermodynamic performance results combined with estimated system weights.

Supporting agency address information: AMC European Research Office, Box 15, US Army FPO, N.Y. 09510

SUPPORTED BY U.S. Dept. of Defense - Army

1.0008, EMISSIONS FROM AIRCRAFT FUEL NOZZLE FLAMES
A.M. MELLOR, Purdue University, School of Mechanical Engin., *Lafayette, Indiana* 47907 (72P21764)

This is an investigation to determine the influence of fuel nozzle parameters on aircraft turbine engine exhaust emissions. The information obtained can be used to identify fuel injection techniques that result in reducing turbine engine emissions.

SUPPORTED BY U.S. Environ. Protect. Agency - O.R.M.

1.0009, THREE AND FOUR DIMENSIONAL AREA NAVIGATION STUDY, SIMULATION AND SYSTEM DEVELOPMENT
UNKNOWN, Collins Radio Company, *Cedar Rapids, Iowa* 52406 (036312 (TRAIS NO.))

Investigate the application of three and four dimensional airborne navigation concepts to increase aviation system capacity, primarily in terminal areas and to develop feasibility airborne hardware for test and evaluation. These terminal areas will have varying degrees of sophisticated approach and landing capability including airports with non-instrumented runways, standard ILS runways and scanning beam type microwave landing system installations. In addition, the level of automated ATC sophistication may be expected to vary from minimal to complex metering and spacing.

Document provided to S.S.I.E. by the T.R.A.I.S.

SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

1.0010, INTERACTION OF SOUND AND HEAT WITH TURBULENCE
L.S. KOVASZNAY, Johns Hopkins University, School of Engineering, *Baltimore, Maryland* 21218 (F44620-74-C-0024)

The Air Force mission requires the operation of aerospace vehicles in the atmosphere. Therefore improvements in the air breathing propulsion systems are required for more efficient and higher performance vehicles. One of the basic problems in determining the flow field within a turbojet engine is that the flow is turbulent and at present cannot be accurately described. Added to the turbulent flow field are the complex three-dimensional flow fields within the compressor and turbine blades and the sound fields and combustion processes superimposed on the system. This research will contribute to the basic understanding of the detailed structure of turbulence, its interaction with sound waves and, with studies of heated wakes, the properties of turbulent heat transport within the flow. With this more detailed understanding, improved flow models can be made to more accurately describe real flows in engines. Research is being conducted in the following areas - (1) interaction of turbulence with sound waves, (2) heated turbulent wake, (3) new turbulence theory and (4) viscous flow theory and associated mathematical problems.

Supporting agency address information: AF Office of Scientific Research NA, 1400 Wilson Blvd., Arlington, Va. 22209

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0011, STUDY OF TIME REFERENCE MODULATION TECHNIQUES FOR APPLICATION IN SCANNED BEAM MICROWAVE LANDING SYSTEMS
UNKNOWN, Meyer Associates Incorporated, *Waltham, Massachusetts* 02154 (055779 (TRAIS NO.))

The purpose of this task is to validate time reference modulation techniques for improving the performance of Microwave Landing Systems (MLS). The time reference modulation process is applicable to both conventional Scan Beam as well as Doppler. The effort defined under this statement of work will include evaluation of experimental data collected by one or more of the present MLS contractors who are flight testing prototype hardware at Wallops Island, Virginia and National Aviation Flight Experimental Center (NAFEC), Atlantic City, New Jersey.

Document provided to S.S.I.E. by the T.R.A.I.S.

SUPPORTED BY U.S. Dept. of Transportation - Off. Sec.

1.0012, INVENTORY DEMAND ANALYSIS AND MANAGEMENT
H.P. GALLIHER, Univ. of Michigan, School of Engineering, *Ann Arbor, Michigan* 48106 (F33615-73-C-4158)

AF function - demand analysis for and management of spare aircraft engines. Deficiency - need for mathematical models for forecasting demand for and for redistribution of engines. Research - inventory demand analysis and management. How research contributes - reduction in requirements for spare aircraft engines.

Two co-investigators will review existing studies and practices, perform the research, and evaluate their theoretical models with the use of some current Air Force engine data. Specifically, the principal investigator will perform an analytic and empirical study of forecasting demand for aircraft engines. He will determine relationships between demand and flying program activity, maintenance policies and other factors. He will develop a demand

forecasting method for these items. Specifically, the associate investigator will review and evaluate existing practices and policies. He will devise and evaluate new policy models for redistribution of spare aircraft engines. He will use computer simulation or other standard operations analysis methods.

Supporting agency address information: Aerospace Research Laboratory LB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0013, VHF ANTENNA FOR HIGH RESOLUTION APPLICATIONS

D.L. SENGUPTA, Univ. of Michigan, Graduate School, *Ann Arbor, Michigan* 48104 (F19628-74-C-0020)

AF function - develop an antenna array suitable for installation on aircraft or missle for use in synthetic aperture radar systems. Deficiency - present techniques and methods are geodynamically inadequate. Research - suitable design data and techniques for array antennas used with synthętic aperture radars. How research contributes - the theoretical techniques developed will aid in the design of suitable array antennas. The effort will be concentrated on experimental verification of theoretical techniques. Design data will be the objective of the work.

Supporting agency address information: AF Cambridge Research Laboratories LZ, L. G. Hanscom Field, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0014, PRE-CHAMBER ENGINE PROGRAM

S.D. JEFFE, Chrysler Corporation, *Detroit, Michigan* 48231

Description: The purpose of this program is to investigate the possible application of a pre-chamber system to an existing production engine. It is directed to lowering exhaust emissions without reducing fuel economy. Included in the work are dynamometer and vehicle evaluations of performance and emissions and durability testing. Component development will center on fuel metering to the pre-chamber and the main chamber.

SUPPORTED BY Chrysler Corporation - Detroit, Mich.

1.0015, ALL-WEATHER ROADS, AIRFIELDS, AND HELIPORT SYSTEMS

S.G. TUCKER, U.S. Army, Waterways Experiment Station, *Vicksburg, Mississippi* 39180

The construction, repair, and rehabilitation of forward areas for the support of combat operations that require excavation, backfill, drainage, and compaction of soil areas are currently impossible during wet, rainy weather for prolonged periods of time. Materials capable of rapid emplacement by mechanical and/or hand-placement methods which provide uninterrupted movements of combat and support forces are needed to ensure the mobility and flexibility of field armies during adverse weather conditions.

Initially, a study of saturated in-situ confined and unconfined soils will be undertaken to identify the performance to be expected when exposed to various types of military traffic. Then a laboratory study will be conducted on selected soils by varying the degree of saturation which may be encountered in field operations. Physical characteristics determined by laboratory evaluations will be used as guides for the selection of waterproofing, drying, bonding, consolidating, and reinforcing wet weather construction materials. The most promising materials will be selected for evaluation in the field.

Supporting agency address information: OCE Waterways Experiment Station, P.O. Box 631, Vicksburg, Mi. 39180

SUPPORTED BY U.S. Dept. of Defense - Army

1.0016, LOW-FREQUENCY RADIO NAVIGATION

A.J. MATTES, U.S. Army, Avionics Laboratory, *Red Bank, New Jersey* 07703

Low frequency navigation systems, such as LORAN, are to be fielded for the first time in the Army, giving it a positioning and navigation capability which it does not now have. To realize the full potential of such a system, this effort is for the study, design, and experimental evaluation of new techniques that will alleviate the perturbing influence of the transmission medium and improve signal processing. It will also allow the Army to acquire a technology base to deal with technical problems that may arise in testing and field use of LORAN.

Low frequency signal propagation and noise-interference data will be collected and a manageable model of the signal propagation medium derived from them. Based on this model, processors will be designed to extract estimates of unpredictable signal delay variations from the received signal directly and in real time, as opposed to presently used methods which rely on predictions and require prior knowledge of relevant parameters of the operational area. Existing receivers require long signal acquisition up to 10 minutes under poor operating conditions. This severely restricts their use under non-stationary operating conditions. To overcome this shortcoming, novel digital signal processors will be devised, to allow short signal acquisition time and improved performance under poor signal conditions. The most promising will be implemented and evaluated through experimental design and testing.

Supporting agency address information: ECOM Avionics Laboratory, (AMSEL-VL-N), US Army Electronics Command, Ft. Monmouth, N.J. 07703

SUPPORTED BY U.S. Dept. of Defense - Army

1.0017, VISCOUS AND INVISCID INTERACTION IN THE HYPERSONIC FLOW REGIME

M.H. BROOM, Polytechnic Inst. of New York, Graduate School, *Brooklyn, New York* 11201 (AF-AFOSR-2787-75)

In order for the AF to improve the operational capabilities of future aerospace vehicles for very high speed (hypersonic) and high altitude missions, advances must be made in the prediction of the characteristics of these high velocity, low density flows. The efficiency of these high performance operations depends on the engineer's ability to design the optimum shape and size vehicles. These complex, three-dimensional designs are dependent on the scientist's basic understanding of this flow regime. This research is developing experimental techniques and applying these to obtain flow field data on hypersonic flight. The primary focus is on the boundary layer about the body of the vehicle. Three particular aspects of these flows are under study experimentally and are being directly correlated with theoretical predictions: (1) transpiration cooling, (2) cone flow boundary layers, (3) two-phase flow diagnostics. Work has been completed on rarefied flow profiles around a hemisphere cylinder and on rarefied nozzle flow.

Supporting agency address information: AF Office of Scientific Research NA, 1400 Wilson Blvd., Arlington, Va. 22209

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0018, MASS ENTRAINMENT BY HYPERMIXING JETS

W. PESCHKE, Bell Aerospace Company, *Buffalo, New York* 14240 (F33615-74-C-4080)

AF function - development of high performance thrust augmenting ejectors for V/STOL aircraft. Deficiency - an optimum design for the hypermixing primary nozzle. Research - directly measure and compare the entrainment by jets issuing from a class of nozzles under a variety of flow conditions. How research contributes - will furnish the data base necessary to improve ejector performance.

The effect of nozzle exit geometry and primary stagnation state on the entrainment by turbulent free jets will be investigated. The rate of entrainment is increased by segmenting the nozzle exit. The optimum number and size of the segments will be identified by systematically changing the exit configuration. The mass of the entrained fluid will be measured directly over a range of initial velocities and temperatures in the jet.

Supporting agency address information: Aerospace Research Laboratory LE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0019, NUMERICAL SOLUTION OF COMPLETE FLOWS AROUND EXTERNAL STORES
Z. POPINSKI, Bell Aerospace Company, *Buffalo, New York* 14240 (F446205JC0003)

Aerospace vehicles used by the Air Force constantly need to be adapted to new tactics which may provide better survivability or better mission results. As new devices are developed for such aircraft, there is the need for better understanding of their behavior especially when such devices are attached to the aircraft as external stores. It is important to determine the behavior in flight, during release and after release of externally carried stores. At present, wind tunnel testing provides partial answers to the behavior question. This research proposal attempts to model the fluid flow around external stores at different angles of attack for laminar flow and for turbulent flow as an extension to a current program. The expected results may be used to understand the behavior of external stores under supersonic flight conditions. The problem is a very difficult one which is being studied by other investigators using different approaches. It involves the solution of three-dimensional parabolic Navier-Stokes equations. The techniques to be used are the implicit finite difference method for the laminar boundary layer flow, the finite element method for the separated flow region, and external pressure distribution generated by the method of characteristics.

Supporting agency address information: AF Office of Scientific Research NM, 1400 Wilson Blvd., Arlington, Va. 22209

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0020, CARBON MONOXIDE GDL DEVELOPMENT
J.W. RICH, Calspan Corporation, *Buffalo, New York* 14221 (F33615-73-C-1285)

The objective is the optimization of parameters leading to a high efficiency laser producing 100-200 watts in the 4.8 to 6.0 micron region. It will strive to increase the pressure in order to minimize the system's pumping requirements. A secondary objective will be the downward scaling to develop the technology necessary for possible (4.8 to 5.1 micrometers) airborne applications.

Parametric studies will include the investigation of the influence of cold gas additives such as Ar, Co, CO2, in addition to IR sidelight and single line operation studies. The high pressure laser study will include the use of He diluent in combination with the annular injection of the gases and a system of aerodynamic baffles. The compact laser component tests shall include parametric studies on a small scale discharge and a small scale nozzle.

Supporting agency address information: AF Avionics Laboratory TEO, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0021, ANALYSIS OF AIR TRAFFIC CONTROL
W.C. GIFFIN, Ohio State University, School of Engineering, *Columbus, Ohio* 43212

The techniques of industrial and systems engineering are being used to analyze and design control procedures within the National Aviation System. In addition active research in air traffic control as reported in the literature is being reduced to a form suitable for classroom presentation in a mission oriented course in Flight Transportation Operations Analysis.

SUPPORTED BY Ohio State University

1.0022, APPLICATION OF PHOTOMECHANICS TO EXPERIMENTAL STRUCTURAL ANALYSIS
F.D. ADAMS, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433

Accurate stress analysis methods are required to accomplish low cost design, development and maintenance of aerospace vehicles. These are used to secure structural integrity for safety and longevity of a system. The objective of this effort is twofold. The first is to apply laser/optical experimental stress analysis technology such as holographic interferometry and speckle photography to current design problems. The second is to improve and/or develop new laser/optical techniques with particular emphasis on reducing the cost of design analysis. The expected payoff is an improvement of in-house capability to advance the state of the art and to provide accurate and reliable analysis with a near term impact on systems such as RPV, AFTI, AMST, ASALM, and B-1.

Under a completed exploratory development program (JON 14670212), specialized holographic and speckle photographic methods have been developed and exploited to experimentally validate finite element stress analysis of structural components. This included strain field measurements around interference fit fasteners installed in fatigue resistant structural joints. The current effort will involve application of this technology to composite, bonded, and weld-bonded structures. Experimental studies concerning structural joints and the stress distribution in the vicinity of fasteners will continue. Techniques for using speckle photography on high temperature structures will be investigated. New techniques which might improve accuracy or reduce analysis cost will be evaluated. A quick response in-house capability will be maintained to solve urgent problems that often arise but are easily disposed of using the unique techniques of photomechanics.

Supporting agency address information: AF Flight Dynamics Laboratory FBR, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0023, MILITARY MEDIUM TRANSPORT AIRCRAFT AIR CUSHION LANDING SYSTEM ACLS TECHNICAL BASE
B.J. BROOKMAN, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433

Air Force medium transport aircraft, such as the C-130, are restricted to operating from fixed paved and semi-prepared airfields. The objective of this work unit is to develop sound, cost effective plans for the development and demonstration of an air cushion landing system (ACLS) on a medium transport. These plans will provide a basis for achieving revolutionary aircraft operation capability to operate on low strength soil surfaces, mud, snow and even water with little or no prior surface preparation.

A review will be made of the XC-8A, Buffalo, ACLS Advanced Development Program and other applicable government and industry work, and existing and future medium military transport design and operational characteristics which effect ACLS design. Then needed ACLS method and criteria development will be identified. Next, an initial development and demonstration plan will be prepared for a medium transport ACLS. This will be reviewed with applicable Air Force and other organizations. Lastly, a detailed plan will be prepared. In addition, related laboratory testing, analysis and criteria development will be done in the areas of ACLS suction braking, trunk vibration and optimum low air flow.

Supporting agency address information: AF Flight Dynamics Laboratory FEM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0024, REMOTELY PILOTED VEHICLE AUTOMATIC LANDING SYSTEM ANALYSIS
M.D. CLADER, U.S. Air Force, Aerospace Med. Res. Lab., *Dayton, Ohio* 45433

This effort will develop a performance model of manually controlled landing of a remotely piloted vehicle. The model will treat the effects of data rate control systems and display effects on manual landing performance. This model will provide the AF flight dynamics lab with analytic design criteria for the manually monitored automatic landing system being developed for the compass COPE remotely piloted vehicle.

Experimental data taken from the AMRL remotely piloted vehicle landing phase simulator will be analyzed using statistical and control theory measurement techniques. This analysis will then be extended to model the manually monitored automatic landing system configuration.

Supporting agency address information: 6570 Aerospace Medical Rsch. Lab. EM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0025, DESIGN EVALUATION OF COCKPIT CONFIGURATIONS FOR DIGITAL INFORMATION SYSTEMS
D.J. SEIFERT, U.S. Air Force, Aerospace Med. Res. Lab., *Dayton, Ohio* 45433

Multiple airborne sensor and processing systems have precipitated an interest in digital systems for integrating and displaying target and aircraft status information. Empirical studies will provide preliminary data for modeling the pilot's performance. The objective here is to study alternate controls and displays and to then embody relevant man models in an overall mission model to examine contingencies not treatable in an experimental program because of the hazard or the hypothetical nature of the injury.

Saint II techniques will be used to capture vehicle dynamics and to describe pilot performance with these postulated vehicle dynamics. Models will be developed to reflect the manner in which pilot performance is expected to change under a variety of workload and environmental conditions precipitated by different control/display configurations. Simulation runs will examine how mission induced changes in environment and workload can impact weapons system effectiveness.

Supporting agency address information: 6570 Aerospace Medical Rsch. Lab. HE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0026, EADI/ALR EVALUATION
M.J. WILSON, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433

Using present landing systems, no independent means of assessing an aircraft position during the approach/landing phase exist. The electronic attitude director indicator/approach and landing radar (EADI/ALR) would provide this back-up guidance. The objectives are to: 1) evaluate the EADI by itself as a primary flight information display, defining the information, format, and symbology to be displayed, and comparing multicolor displays to monochromatic displays; 2) evaluate the ALR picture superimposed upon the EADI, and 3) evaluate the EADI/ALR combination as a landing monitor and as a source of back-up guidance.

When project pilots are sitting in the jump seat as observers, they will complete questionnaires about the EADI and EADI/ALR capabilities. The pilot will also fly approaches using the EADI alone, and the EADI/ALR system as a primary guidance display. Subjective flyability data and objective tracking performance data will be collected.

Supporting agency address information: AF Flight Dynamics Laboratory FGS, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0027, 150 KVA SAMARIUM COBALT VSCF STARTER GENERATOR ELECTRIC SYSTEM
E. NAGORSKI, General Electric Company, *Erie, Pennsylvania* 16511 (F33615-74-C-2037)

The objective of this program is to demonstrate the feasibility and manufacturing techniques for the application of rare earth magnetics in a 150 kva variable speed constant frequency (VSCF) starter-generator electrical system. The magnets shall be used as the sole source of excitation in a brushless generator that shall, in conjunction with a solid state power cycloconverter, be capable of (1) generating 150 kva, 400 Hz aircraft-quality power, and (2) function in a reverse power flow mode as a starter motor energized from a separate 400 Hz power source. The electrical system must meet the requirements of MIL-E-23001A relating to power quality except as modified herein.

This program will consist of three phases- (1) preliminary system design, samarium cobalt rotor construction and test, (2) fabrication of laboratory prototype starter-generator and converter/control unit, and (3) component and system evaluation tests. The implementation of phases 2 and 3 is dependent upon the successful completion of phase 1 and shall not be initiated prior to approval of phase 1 by the procuring contracting officer.

Supporting agency address information: AF Aero-Propulsion Laboratory POD, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0028, THE J INTEGRAL AS A MEASURE OF FRACTURE RESISTANCE OF MASSIVE AIRFRAME COMPONENTS
C.E. NEU, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974

To determine the applicability of the j integral test on small specimens as a reliable measure of fracture resistance of massive airframe components.

With plain strain fracture toughness tests (KiC) as controls, j integral tests will be performed on selected tough steels and titanium alloys with various specimen sizes from small to massive airframe component size simulation. The j integral specimens will be of either the compact tension or deep cracked bend type. Test results will be correlated to determine whether or not small specimen tests can be used to reliably predict failure of large specimens or components through the use of this analytical technique.

Supporting agency address information: Naval Air Systems Command (320), Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0029, MULTI-BYPASS RATIO PROPULSION SYSTEM
K.R. MARSH, Vought Aeronautics Company, *Dallas, Texas* 75222 (N00019-74-C-0434)

Conduct experimental evaluation of 1.5 inch span and 12 inch span cross flow fan test units to determine aero/thermodynamic characteristics. Conduct analytical studies to identify critical cross flow fan structural design criteria and select candidate materials. Conduct analytical studies of cross flow fan as an element of a multi bypass ratio propulsion system and evaluate interface and airframe integration problems.

Perform analytical analyses of fan structural design. Conduct tests of sub-scale units, in size as indicated above. Evaluate interface and airframe integration problems.

Supporting agency address information: Naval Air Systems Command 330E, Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0030, A COMPREHENSIVE STUDY OF AIRCRAFT GAS TURBINE ENGINES
G. OATES, Univ. of Washington, School of Engineering, *Seattle, Washington* 98105 (AF-AFOSR-2783-75)

The purpose of this task is to provide a scientific report containing an advanced and comprehensive description of the fundamental theory, performance and aerodynamics of modern aircraft gas turbine engines available to the many specialists working on gas turbine engines and their components. This program will help in giving each component specialist an insight into the effect of component performance on engine performance. The work will be divided into two tasks and each task will culminate in a comprehensive written report and a formal lecture series. The first task will encompass basic thermodynamic and fluid flow concepts required to effectively deal with the performance of a modern gas turbine. The second task shall encompass engine aerodynamics and specific advanced topics related to design and operational problems of a modern gas turbine and its components.

Supporting agency address information: AF Office of Scientific Research NA, 1400 Wilson Blvd., Arlington, Va. 22209

SUPPORTED BY U.S. Dept. of Defense - Air Force

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, AERONAUTICAL L-BAND COMMUNICATION TEST ACTIVITIES
F. JEFFERSON, U.S. Dept. of Transportation, National Aviation Facility, *Atlantic City, New Jersey* 08405 (055802 (TRAIS NO.))

Provide services, labor, materials, test equipment and facilities in various locations in support of DOT/TSC Aeronautical L-Band Communication Test Activities during the ATS-F Satellite Communication Experiments in accordance with Exhibit 'A' dated May 1, 1974.

Document provided to S.S.I.E. by the T.R.A.I.S.

SUPPORTED BY U.S. Dept. of Transportation - Off. Sec.

2.0002, EVALUATION OF METAL/GAS CELLS FOR AEROSPACE POWER SOURCES
I.F. LUKE, U.S. Air Force, Aero Propulsion Lab., *Dayton, Ohio* 45433

To construct experimental metal/gas cells, especially NiH2, in- house. To characterize the performance of the cells, and determine possible life limiting mechanisms of the cells under various power profiles. To provide in-house support to NiH2 contractual programs. The results of these studies, in conjunction with other data, will be used to evaluate the feasibility of using these hybrid (metal/gas) cells for various Air Force satellite and aircraft uses.

Design and construct NiH2 and possible AgH2 cells. Obtain contractually-supplied NiH2 cells of various designs. Evaluate these cells to determine their performance characteristics under various cycling profiles. After performance evaluation, the cells will be cycled to determine the time related degradation of life limiting features.

Supporting agency address information: AF Aero-Propulsion Laboratory POE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

2.0003, EXPERIMENTAL RESEARCH OPERATIONS
D.H. MURRAY, U.S. Air Force, Aerospace Research Labs., *Dayton, Ohio*

AF function - advanced aerospace vehicles (supersonic and hypersonic flight). Deficiency - inadequate understanding of environmental influences affecting high speed flight vehicle characteristics. Limited range of flight conditions which can be simulated in present ground test facilities. Research - investigation of new methods for improving the design, simulation range, instrumentation and data production capabilities of supersonic and hypersonic ground test facilities. How research contributes - will result in new or improved ground testing capabilities needed to provide data for the design, development or evaluation of flight vehicles and air weapons. Will advance diagnostic methods pertaining to experimental research in fluid dynamics and data acquisition in high speed wind tunnels and other gas flow test facilities.

Maintain a state-of-the-art capability in test media and measurement techniques by conducting aerodynamic and fluid dynamic studies for in-house and outside investigators. Continuously upgrade the flow quality and testing flexibility of facilities through design modifications and improved operating methods. Investigate new measurement and recording techniques for possible development and incorporation. Provide consultation services and direct assistance to facility users in formulating, scheduling, conducting, and evaluating their test programs. Document and disseminate progress through research and engineering reports and papers.

Supporting agency address information: Aerospace Research Laboratory LF, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

2.0004, RESEARCH IN FLIGHT MECHANICS
K.F. STETSON, U.S. Air Force, Aerospace Research Labs., *Dayton, Ohio*

Af function - advanced aerospace vehicles. Deficiency - an aerospace vehicle, when traveling at high velocities, generates complex interactions with the air through which it is traveling. These aerodynamic phenomena account for the aerodynamic forces on the vehicle and influence its flight path and the aerodynamic heating to the vehicle structure. Many of these high speed aerodynamic phenomena are not well understood. A deficiency exists in the high-speed aerodynamic technology base which may compromise the design of a future aerospace flight system and may limit the confidence level of its performance predictions. research - conducts research on aerodynamic problems associated with advanced aerospace vehicles. How research contributes - by improving the technology base in the area of high-speed aerodynamics it will be possible to better understand the complex aerodynamic phenomena associated with the flight of advanced aerospace systems. This will then permit improved design and performance predictions of advanced aerospace systems.

To conduct and sponsor theoretical and experimental research on aerodynamic problems of high speed flight vehicles such as reentry vehicles and high performance aircraft. Emphasis will be given to vehicle stability, vehicle flight characteristics, and flow fields surrounding vehicles in flight.

Supporting agency address information: Aerospace Research Laboratory LF, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, MECHANISMS OF GRAPHITE FORMATION IN GRAY AND DUCTILE CAST IRON 11023-MC
C.E. BATES, Southern Research Institute, *Birmingham, Alabama* 35205 (DA-ARO(D)-31-124-73-G50)

To improve the understanding of the solidification of cast iron, and especially the forces controlling the direction of growth of graphite in the iron, so that the mechanism of growth may be sought. The Army uses great tonnages of cast irons, for example, in sheels, and in the blocks, heads, and crankshafts of vehicular engines. All these and other uses of ductile irons should be promoted by the developments that will follow better understanding of the mechanisms of formation of nodular graphite as is proposed in this project.

Included in the research will be following experimental program- 1. Determination of the surface tension of each of several irons to which surface-active elements have been added (e.g., S, Pb, Bi, Ce). 2. Determination of the interfacial energy of each iron on the basal and the prism plane of graphite. 3. Determination of the concentration of solute elements adsorbed from the iron upon the basal and the prism plane of graphite, by use of radioactive tracers, or by appropriate other means. (For some elements, the amount adsorbed may be calculable from the consequent change in the interfacial energy of the iron.)

Supporting agency address information: OCRD Research Office Durham, Durham, N.C. 27706

SUPPORTED BY U.S. Dept. of Defense - Army

3.0002, PETROLEUM PRODUCT RESEARCH AND TECHNOLOGY
J.R. THOMAS, Chevron Research Company, *Richmond, California* 94802

Description: Research and development to optimize performance and economics of petroleum fuels and lubricants, including work on such materials as gasoline, diesel fuel, jet fuel, heating fuels, lubricating oils, greases and fuel and lubricant additives.

SUPPORTED BY Standard Oil Co. of Calif. - San Francisco

3.0003, FUNDAMENTALS OF FATIGUE CRACK INITIATION AND GROWTH IN IN-SITU COMPOSITES
A.J. MCEVILY, Univ. of Connecticut, School of Engineering, *Storrs, Connecticut* 06268

Certain in-situ composites exhibit superior tensile and creep strengths at elevated temperatures and for this reason they are being considered for use as gas turbine engine blades or vanes. However, in such applications stress concentrations are expected to play an important role in the initiation and growth of fatigue cracks. To date very little is known about this aspect of the behavior of in-situ composites. The proposed program is aimed at

determining the behavior of these composites at room and elevated temperatures as influenced by stress raisers. Three systems are proposed for study. One contains brittle fibers in a ductile matrix (Co,Cr,Ni-TaC), the second contains ductile fibers in a ductile matrix (Ni3Al-Mo), and the third is a lamellar composite (Ni, Ni3Al-Ni3Cb). Comparison of crack initiation and propagation characteristics among these will add to our understanding of composite behavior. The program will also provide data useful to the design engineer in making material selections.

SUPPORTED BY U.S. Natl. Science Foundation

3.0004, NAVY ENVIRONMENT - ENVIRONMENTAL EFFECTS IN STRESS CORROSION CRACKING IN ALUMINUM ALLOYS

R.T. FOLEY, Amer. University, School of Arts, *Washington, District of Columbia* 20016 (N00014-68-A-0245-0009)

The objective of this task is to clarify the role of environmental factors in stress corrosion cracking of aluminum alloys used in naval aircraft and craft.

An experimental program is to be conducted to study the effect of various anions in pitting initiation in aluminum alloys, a study of local solution chemistry in these alloys, and a testing phase to correlate the first two approaches with susceptibility of the alloys to stress corrosion cracking. Standard electrochemical and fracture mechanics techniques are to be used for this study.

Supporting agency address information: Office of Naval Research, Arlington, Va. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0005, THERMAL EXPANSION COMPILATION

R.K. KIRBY, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234

The thermal expansion compilation effort is aimed at preparing critically evaluated data on elements and selected compounds for publication in the TPRC Data Series.

Objective: The thermal expansion effort involves the critical evaluation of data on the thermal expansion of elements and selected compounds.

Motivation: Standard reference data on thermal expansion is needed by those industries (aerospace, transportation, energy, materials, etc.) where thermophysical properties are a necessary part of the applied technology or manufacturing requirements.

Approach: The initial phase of the thermal expansion activity is a cooperative effort with the Thermophysical Properties Research Center at Purdue University. It involves the assessment of data sources, an error analysis, and the recommendation of best values based on information extracted from literature sources and put into graphic form by TPRC. This activity will result in the publication of two volumes in the TPRC Data Series.

Progress: For the thermal expansion work, the critical evaluation of the elements was nearly completed. In addition, the data on eight more oxides was evaluated and the introduction to Volume 12 of the TPRC Data Series was written.

Plans: The cooperative effort with TPRC on the publication of Volumes 12 and 13 of their series will be completed with the critical evaluation of the thermal expansion data for the nonmetallic elements and selected oxides.

SUPPORTED BY U.S. Dept. of Commerce - N.B.S.

3.0006, THE SCIENCE OF CERAMIC PROCESSING BEFORE FIRING, NINTH ANNUAL UNIVERSITY CONFERENCE ON CERAMIC SCIENCE 12584-MS

G. ONODA, Univ. of Florida, School of Engineering, *Gainesville, Florida* 32601 (DAHC04-75-G-0014)

To organize and host an International Conference on the Science of the Processing of Ceramics that Precedes Final Heat Treatment. This conference is relevant to the technology of processing of ceramic materials, a topic which is extremely important to the control of the properties of these materials. Ceramic materials which are used in Army hardware (and hence to which this conference is relevant) include electrical insulators, microwave dielectrics for phase shifters and microcircuit substrates, ferroelectrics for filters and transducers, electrooptical materials, rocket nozzles and radomes, transparent armor, turbine components.

The program will include, but will not be limited to, the following topics- (1) raw material preparation- (2) powder characterization- (3) water-particulate systems- (4) forming.

Supporting agency address information: AMC Army Rsch. Office, (ARO- D), Durham, N.C. 28206

SUPPORTED BY U.S. Dept. of Defense - Army

3.0007, CONVERSION OF HIGHER BOILING DISTILLATES

E.L. POLLITZER, Univ. Oil Products Company, *Des Plaines, Illinois* 60016

Description: This is an ongoing program directed towards the conversion of higher boiling distillates (usually atmospheric and/or vacuum gas oil) to lower boiling materials - primarily transportation fuels and middle distillates. Two principal techniques are under investigation: (1) Catalytic cracking, most commonly used for the production of gasoline and more rarely for middle distillates. (2) Catalytic high-pressure hydrocracking is the most efficient process available for the production of middle distillates including jet fuels. It can also be used for the production of gasoline and LPG. The processes are commercial and current work is directed towards improvements.

SUPPORTED BY Universal Oil Prod. Co. - Des Plaines, Ill

3.0008, MECHANICAL BEHAVIOR OF MULTIPHASE COMPOSITE SYSTEMS

O. ISHAI, Technion, *Haifa, Israel* (DAJA37-74-C-2531)

The Principal Investigator will conduct an analytical and experimental study of metal fiber-reinforced polymer (F.R.P.) hybrid composites to determine, among other things, the stress-strain distributions, especially of the composite interface, and the performance of the adhesive interlayers under stress in terms of bonding, corrosion resistance, relaxation, etc. The importance of this research is the unique opportunity provided by composite materials for structural dynamic tuning to be used extensively on future army helicopters.

The study will utilize three hybrid models- the symmetric metal/F.R.P. laminate under tension, the symmetric double-lap shear joint metal/F.R.P. laminate under tension, and the non-symmetric metal/F.R.P. laminate under flexure. The stress-strain distributions will be studied by shear-lag analysis and with the aid of laminate theories similar to those postulated by others.

Supporting agency address information: OCRD - European Research Office, Box 15, FPO US Forces, N.Y. 09510

SUPPORTED BY U.S. Dept. of Defense - Army

3.0009, PULSE FLOW CHEMICAL REACTOR

N. KLEIN, U.S. Army, Ballistic Research Lab., *Aberdeen Proving Ground, Maryland* 21005

To install and make operational a high pressure, high temperature, pulsed flow chemical reactor.

The reactor is currently being fabricated and is scheduled for delivery early in FY75. Upon delivery, it will be installed, tested, and made operational for study of reactions associated with propellant burning under conditions of high temperature and/or high pressure.

Supporting agency address information: AMC Ballistic Research Labs, Aberdeen PG, Md. 21005

SUPPORTED BY U.S. Dept. of Defense - Army

3.0010, AN ULTRASONIC TECHNIQUE FOR DETECTION OF THE ONSET OF FATIGUE DAMAGE

R.E. GREEN, Johns Hopkins University, School of Engineering, *Baltimore, Maryland* 21218 (F44620-71-C-0062)

This research aims at developing the most advantageous ultrasonic techniques for the early detection of fatigue damage in AF flight vehicle structures. One of the promising techniques, acoustic emission, will not reach its full potential nor be of practical use in many important applications unless the basic causes of the emissions are elucidated. A systematic study will be made of

the acoustic emissions from predominantly twinning (indium single crystals), slip and microcracking (aluminum single crystals) and from both slip twinning and microcracking (Ti and Mg). By coupling multiple beam interferometry with cinemicrography, the surface deformations of the crystals will be correlated with the acoustic emissions. Similar experiments will be performed on various polycrystalline metal specimens. Analysis will be carried out in all the above tests to distinguish between the various modes of deformation and the emission patterns. Also, ultrasonic attenuation measurements will be made simultaneously with the acoustic emissions on all test specimens possible to determine whether the extent of slip, twinning, crack formation, and fracture can be related to these techniques and to determine the advantages and disadvantages of these methods (previously shown superior to a number of others) as continuous monitors of fatigue cycling and predictors of fatigue failure.

Supporting agency address information: AF Office of Scientific Research NA, 1400 Wilson Blvd., Arlington, Va. 22209

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0011, MATERIALS FOR SURVIVABLE RADOME
H.A. PERRY, U.S. Navy, Chemistry Research Department, *Silver Spring, Maryland* 20910

To develop materials for the periscope-mounted antenna cover of the trident microwave satellite communications system.

Develop materials for a dielectric sandwich structure comprising a prestressed glass or ceramic shell, which has a high ratio of strength to microwave attenuation, and which is protected by a coating which is non-reflective, transmissive, adherent and sheds seawater films. Compound and test materials, improve candidates and select pairs with required dielectric, structural, and non-wetting properties.

Supporting agency address information: Naval Electronic Systems Command ELEX-304, Washington, D.C. 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0012, MATERIAL CHARACTERIZATION PROCEDURES FOR DESIGN OF PAVEMENTS
W.N. BRABSTON, U.S. Army, Waterways Experiment Station, *Vicksburg, Mississippi* 39180

To develop methodology for characterizing the structural properties of various types of pavement materials and to formulate this methodology into definitive procedures that will yield quantitative parmeters for design of road and airfield pavements using existing or newly developed theoretical and semi-theoretical criteria.

A range of materials that are acceptable for use in the design of pavements will be considered. Various types of laboratory test procedures will be studied to determine methods of integrating the quantitative output of acceptable laboratory tests with conventional material acceptability standards, such as gradation, plasticity etc. Material characterization procedures will be developed to provide the user with direct and/or indirect methods of obtaining quantitative design parameters.

Supporting agency address information: OCE US Army Engineer Waterways Experiment Station, PO Box 631, Vicksburg, Ms. 39180

SUPPORTED BY U.S. Dept. of Defense - Army

3.0013, MATERIALS SUPPORT TECHNOLOGY - CHEMICALLY PRODUCED EXCITED STATES
J. WIESENFELD, Cornell University, School of Arts, *Ithaca, New York* 14850 (N00014-67-A-0077-0030)

The Navy has need for more detailed knowledge of chemical reaction kinetics under the general category of materials support technology. Particular items within this category of interest here are new techniques for chemical synthesis, rocket propellants with modified plume radiation characteristics, and new materials for chemical lasers.

This work involves energy partitioning in atomic and molecular product species arising from bimolecular gas phase reactions. The first experimental investigations will be aimed at ascertaining whether electronically excited atomic species can be produced by particular chemical reactions. The measurement technique will be primarily time- resolved atomic absorption spectroscopy.

Supporting agency address information: Office of Naval Research 421, Arlington, Va. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0014, GRAIN BOUNDARY ENERGETICS IN NON-OXIDE CERAMICS
A.H. HEUER, Case Western Reserve Univ., School of Engineering, *Cleveland, Ohio* 44106 (AF-AFOSR-2789-75)

Small economical ceramic turbine engines are being developed for the propulsion of Air Force vehicles, RPV's for example. Silicon carbine and silicon nitride type ceramics, formed by sintering powders at high temperatures, provide strong vanes and blades for such turbines. This research will investigate the mechanism of sintering in silicon carbide, silicon nitride and other non-oxide ceramics and also the deformation mechanisms in these materials. The grain boundary energetics will be studied by measuring the dihedral angles at grain boundary/pore intersections using transmission electron microscopy. Adjusting the grain boundary energy with additives will change the fabrication parameters and alter the high temperature creep behavior of these materials.

Supporting agency address information: AF Office of Scientific Research NE, 1400 Wilson Blvd., Arlington, Va. 22209

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0015, THE FUNDAMENTAL DESIGN OF TITANIUM-ALUMINIDE-BASE INTERMETALLIC COMPOUNDS
E.W. COLLINGS, Battelle Memorial Institute, *Columbus, Ohio* 43201 (AF-AFOSR-2786-75)

AFAPL requirements for turbine engine materials for an advanced tactical fighter plane for use in the 1980's presents two research- oriented problems requiring solutions from the field of materials science. First, the need for materials to operate at higher engine temperatures to improve operating efficiency, and second, the need for lighter weight materials to decrease engine weight, engine operating stresses due to heavy components, and fuel consumption. The needed materials must have the same density as titanium combined with the mechanical properties and oxidation resistance of nickel base superalloys. The titanium aluminides have exhibited great potential for such applications. The objective of this research is to establish the fundamental principles required for designing titanium aluminide intermetallic compounds with improved high temperature strength and room temperature ductility. This will be undertaken through experimental and theoretical analysis of the effects of alloying on the bonding characteristics, particularly directionality and anisotropy, since these are responsible for resulting strength and ductility.

Supporting agency address information: AF Office of Scientific Research NE, 1400 Wilson Blvd., Arlington, Va. 22209

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0016, STUDIES OF THE RELATIONSHIP OF INTERFACIAL SEGREGATION PHENOMENA TO FRACTURE AND ENVIRONMENT RESISTANT MATERIALS
T.W. HAAS, U.S. Air Force, Aerospace Research Labs., *Dayton, Ohio*

AF function - flight vehicles, structures. Deficiency - need for improved fracture toughened, environment resistant materials. Research - study role played by interfacial segregation on embrittlement, oxidation and corrosion resistance. How research contributes - identifies elements in alloys and compounds that segregate to grain boundary and free surface interfaces which are beneficial or detrimental to fracture toughness and environment resistance.

Elements added to alloys as well as trace contaminants have been found to segregate during thermal stress or mechanical working of materials. This segregation may be beneficial in adding environment resistance, but may also be detrimental in weakening grain boundary adhesion (embrittlement). This research will study this segregation phenomena in AF materials such as Ti alloys, silicon nitrides, Rene alloys, and others using

such techniques as auger electron spectroscopy and soft x- ray appearance potential spectroscopy. Elements which are found to segregate preferentially will be classified according to their effects on materials properties so that future materials can be optimally designed.

Supporting agency address information: Aerospace Research Laboratory LJ, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0017, MECHANICAL BEHAVIOR OF CERAMICS
L.A. JACOBSON, U.S. Air Force, Aerospace Research Labs., *Dayton, Ohio*

AF function - advanced aerospace vehicles. Deficiency - turbine engine propulsion systems for small, unmanned RPV or drone aircraft require lower cost high temperature materials. Large high performance turbine engines require materials which will not require cooling air. Research - investigation of mechanical properties of brittle ceramics. How research contributes - definitive mechanical property tests will aid in development of new improved ceramics and will improve ability to formulate reliable design techniques. The aim of this effort is two-fold - to develop test methods for determining mechanical properties of brittle ceramics and to apply these tests to both evaluate newly emerging ceramic materials and generate meaningful data on state-of-the- art ceramics that will be pertinent to the use of these materials in structural application.

Fracture mechanics test methods will be applied to determine critical stress intensity factors under simple loading geometry. Similar methods will be used to determine stable crack growth rates under varying stress intensity temperature and environment. Microstructural studies will be undertaken to determine mechanisms which govern observed behavior.

Supporting agency address information: Aerospace Research Laboratory LL, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0018, RESEARCH ON IR MATERIALS
D.W. LANGER, U.S. Air Force, Aerospace Research Labs., *Dayton, Ohio*

AF function - surveillance, target identification. Deficiency - high quality, low cost materials for IR detection and IR imaging in the spectral range between 1 and 10 microns. Though materials and highly efficient systems are available the need for active sensors with better reproducibility and long term stability exists. Research - develop IR sensitive materials suitable for low cost detectors or image devices. Photoconductive materials, junction devices and upconverting phosphors are to be investigated. How research contributes - results will enable the Air Force to select the best material for fabrication of thin film or layer type image converters for cooled or uncooled operation. The converter output should be 1) a conductivity change suitable to be 'read' on electroluminescent screen or 2) luminescent emission readable by a conventional vidicon or starlight scope.

Materials research on 1) HgCdTe will be performed for a variety of Hg-Cd compositions in order to produce the most homogeneous and reproducible areas for a given composition and 2) GaAs phosphors which show a maximum photoresponse or upconverted photoresponse in the near IR region from 1.5 to 2.5 microns. For this purpose trap levels will be studied in GaAs by means of thermally stimulated current or luminescence and correlated to the desirable device requirements.

Supporting agency address information: Aerospace Research Laboratory LS, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0019, ANALYSIS OF NON-HOMOGENEOUS DEFORMATION OF COMPOSITE MATERIALS 11673-E
B. AVITZUR, Lehigh University, School of Engineering, *Bethlehem, Pennsylvania* 18015 (DAHC04-74-G-0167)

To carry out an analytical study of the non-homogeneous deformation of composite materials and to provide substantial experimental verification. Composite materials are of great use in target material, penetrators, personnel armor, helicopters, just to mention a few. As the reviewer from AMMRC notes, 'practically all real materials are composites....this work has broad, fundamental applicability and relevance to the solution of Army materials problems.' 'These results should contribute to the development of improved methods for forming composites.'

A model is set up consisting of a small cylindrical element of soft matrix surrounding a single cylindrical inclusion of a harder material. This has sufficient flexibility to model a wide variety of composites. This model will be analyzed by the so-called 'upper bound method' for determing tensile strength.

Supporting agency address information: OCRD Army Research Office, Box CM, Duke Station, Durham, N.C. 27706

SUPPORTED BY U.S. Dept. of Defense - Army

3.0020, LITHIUM-INORGANIC ELECTROLYTE BATTERY INVESTIGATION
R. WALK, Honeywell Incorporated, *Montogomerville, Pennsylvania* 18936 (F33615-74-C-2071)

The objective of this effort is to determine the performance capability of lithium inorganic oxychloride battery system toward certain goals.

This is a 19 month effort consisting of three tasks directed at each of the three classes of applications. Task 1 - Life Support, Task 2 - Spacecraft 'A', and Task 3 - Spacecraft 'B'.

Supporting agency address information: AF Aero-Propulsion Laboratory POE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0021, ULTRASONIC PROCEDURES FOR THE DETERMINATION OF BOND STRENGTH
J.L. ROSE, Drexel University, School of Engineering, *Philadelphia, Pennsylvania* 19104 (AF-AFOSR-2480-73)

The weight saving in AF aircraft and missiles achieved by the use of adhesive bonding can go into increased vehicle pay load. However, a reliable method of nondestructively determining the adhesive bond strength of joints is needed to eliminate possible failures. Parameters based on C scan ultrasonics and ultrasonic spectroscopy will be used for the determination of the strength of adhesive bonds. The bond strength as a function of geometrical variations of various lap joints and bonded joint designs will be found for metal to metal bonds and metal to composite bonds. The effects of several processing variables that may affect the strength characteristics and in-service performance of the bonds will be studied. The effects of known flaws of various shapes and sizes on the strength of a joint will also be investigated. Results from the analysis of a metal to metal adhesive bond system will be used to obtain a better understanding of the signal interpretation problems associated with standard echo time analysis and also with the frequency shifts and changes in amplitude associated with ultrasonic spectroscopy analysis.

Supporting agency address information: AF Office of Scientific Research NA, 1400 Wilson Blvd., Arlington, Va. 22209

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0022, JET FUEL CLEANSING SYSTEM
W. WOMER, U.S. Navy, Air Engineering Center, *Philadelphia, Pennsylvania* 19112

The objective of this program is to examine the efficacy of a proposed piece of (R&D class) equipment designed to remove the previously defined contaminants from jet fuel and restore it to refinery output quality.

A total-contaminant removal device for jet fuel based on the utilization of electrokinetic forces will be evaluated. However, the distribution and electrical levels of the electrokinetic forces presented to the fuel flow to achieve the specified scope of cleansing action are not yet defined within the state-of-the-art. The performance of the proposed equipment would be evaluated against that of coalescer and monitor elements, and electrostatic discharge components, all of which will be used as standards. The evaluation program will determine the operational parameters necessary to equal or exceed the performance of the specified standards. The new equipment would be applied to fuel moving to the airplane and, conversely, to the reclamation of fuel removed

from aircraft for return to fuel farm or storage tanks. In the latter respect, there currently is no provision for the in-house reclamation of fuel for return to the upstream fuel storage facility.

Supporting agency address information: Naval Air Systems Command 340E, Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0023, ADVANCED TECHNOLOGY

UNKNOWN, Boeing Company, *Seattle*, *Washington* 98108 (036112 (TRAIS NO.))

Continuance of the following tasks which were near completion at the time that the Supersonic Transport Program was terminated: 1) Titanium Structures: 2) Fuel Tank Sealant: 3) Noise Suppressor and Nozzle Development: 4) Flight Controls Development: 5) Flutter Development: 6) Advanced Electronic Displays: 7) Variable Speed Constant Frequency Generation System.

Document provided to S.S.I.E. by the T.R.A.I.S.

SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

3.0024, IONIZATION PROCESSES RELEVANT TO THE FORMATION OF NEW MATERIALS

H.L. GOERING, Univ. of Wisconsin, School of Letters, *Madison*, *Wisconsin* 53706 (AF-AFOSR-1972-71)

Current and future Air Force flight operations place increasing demands on polymeric materials used as protective coatings. Requirements exist for coatings having better durability, weatherability, and recoatability for use in operational aircraft. The fundamental structural, stereochemical, and kinetic problems associated with ion-pair intermediates (formed from the positive and negative charged segments of a dissociating molecule) to which this research addresses itself, are of utmost importance to polymerization technologies dependent upon ionic processes. The work is a prerequisite for the development of structurally desirable, thermally stable coatings and other polymeric materials. The research involves investigations of the chemistry and stereochemistry of ionic intermediates involved in carbonium ion reactions. An analytical technique required for much of the work is being developed. This technique involves the use of optically active lanthanide NMR shift reagents for direct determination of enantiomeric compositions (optical purities) by NMR spectroscopy. In this connection, various optically active lanthanide and uranium chelates are being examined.

Supporting agency address information: AF Office of Scientific Research NC, 1400 Wilson Blvd., Arlington, Va. 22209

SUPPORTED BY U.S. Dept. of Defense - Air Force

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, IMPLEMENTATION OF DIGITAL FILTERS ON THE INTEL MICROPROCESSOR

C.M. SCHADE, U.S. Air Force, Frank J. Seiler Res. Lab., *Colorado Springs*, *Colorado* 80840

AF function - digital data processing. Deficiency - it appears that the recent advances in the field of digital microprocessors has drastically affected the realization of digital computing and control systems. However, the use of microprocessors for data acquisition and digital filtering has not been evaluated to date and the capabilities and limitations of these processors have not been determined. How research contributes - enables the designers of digital data acquisition systems to base their designs on measured capabilities and limitations. Abstract - microprocessors represent a quantum jump in digital technology which has not been completely evaluated. With the Air Force trend to more and more digital avionics on aircraft, it is imperative that this technology be understood. This research will evaluate a particular microprocesor (the INTEL) and determine the effects of various digital filters on the capabilities of the microprocessor. In addition to the digital filters, the effects of digital word length, data rates and roll-off characteristics will be investigated. A final goal of this research will be to determine possible military applications for the microprocessor.

Supporting agency address information: Frank J. Seiler Research Lab NH, USAF Academy, Colo. 80840

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0002, COMBINING IMPATT DIODE CHIPS

W. COX, Georgia Inst. of Technology, Graduate School, *Atlanta*, *Georgia* 30332 (F33615-75-C-1020)

To develop techniques for interconnecting a number of avalanche diodes in a series-parallel array, such that the array of diodes behaves like a single diode. The intent is to increase power levels, facilitate impedance matching, and increase bandwidth capabilities significantly beyond that possible with single diodes. An added advantage can be gained by optimizing the input DC voltage to simplify power supply requirements.

The approach will be to interconnect the chips electrically in series-parallel arrays such that all diodes are in parallel thermally. The diodes will therefore be mounted on a common substrate which is electrically insulating and of high thermal conductivity, such as diamond or beryllium oxide. Stabilization networks will be included in the connecting circuitry.

Supporting agency address information: AF Avionics Laboratory TEM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0003, ENERGY CONVERSION - STAGNATION REGION GAS FILM COOLING FOR TURBINE COOLING APPLICATIONS

B.A. REESE, Purdue University, School of Aeronautics, *Lafayette*, *Indiana* 47907 (N00014-67-A-0226-0024)

The objective of this project is to obtain accurate data on the local rate of convective heat transfer to a highly cooled surface exposed to an accelerated and highly turbulent hot gas flow, with particular emphasis on the influence of turbulence scale and intensity and unsteady effects on stagnation region film cooling. The effort is primarily experimental, with analytical modeling backup, and is aimed at optimizing engine performance while utilizing higher turbine inlet temperatures with necessary cooling schemes. The research will contribute to increasing the performance of gas-turbine engines needed particularly for naval aircraft propulsion, but useful as well to marine power plants and fixed installations.

An existing test section (two-dimensional cascade) fabricated under NASA sponsorship and consisting of a rectangular duct supplying heated air flow to a film cooled cylindrical test surface will be utilized to obtain accurate data on local rate of convective heat transfer to the highly cooled surface exposed to an accelerated and highly turbulent hot gas flow. Parametric study of the fil coolant injection geometry will be undertaken as part of phase I, first year effort.

Supporting agency address information: Office of Naval Research 473, Arlington, Va. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0004, FATIGUE BEHAVIOR OF STRINGERS IN STIFFENED PANELS

A. SALVETTI, Univ. Degli Studi, *Pisa*, *Italy* (DA ERO 124 74 G0042)

This is a continuation of previous efforts reported under DAOB 9361 and 94019.

This effort is aimed at determining the influence of the position of the crack propogation line with respect to rivet holes on the crack length lamda in the sheet, at which a crack starts in the stiffener, and the fatigue stress concentration factor kf. Also, the influence of the various types of riveted connections normally found in aircraft construction of kf will be determined.

Supporting agency address information: OCRD - European Research Office, Box 15, FPO US Forces, N.Y. 09510

SUPPORTED BY U.S. Dept. of Defense - Army

4.0005, MODIFY DIGISONDE EQUIPMENT
K. BIBL, Lowell Technological Institute, Graduate School, *Lowell, Massachusetts* 01854 (F19628-75-C-0015)

AF function - communications and detection. Deficiency - prediction and real time specification of the arctic ionosphere. Research - modify existing ionospheric digital sounding system at AFCRL Goose Bay Ionospheric Observatory and the existing airborne digisonde to improve equipment performance for routine operations and insure compatibility between digisonde systems. How research contributes - provides further progress in digital sounding techniques through the modification of ionospheric sounding equipment at the AFCRL Goose Bay Ionospheric Observatory and the NKC 135 Research Aircraft. The contractual efforts also provide maintenance support and consultation on complex systems. The Goose Bay ionospheric data are essential in the Laboratory's research efforts in providing an Hf systems model of the arctic ionosphere.

Provide maintenance of digital sounding and processing equipment. Develop improved techniques for analysis, processing and display of digital ionograms. Develop methods for noise reduction and data compression for digital ionograms. Incorporate improvements in Goose Bay Observatory and airborne observatory. Provide technical support and material for modification of aircraft and Goose Bay Observatory digital ionosondes. Operate Doppler angle of arrival spectral measurement in backscatter and forward scatter modes and provide data for reduction. Reduce digital ionograms for publication in AFCRL Geophysical Bulletin.

Supporting agency address information: AF Cambridge Research Laboratories LI, L. G. Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0006, VHF DATA LINK SYSTEMS TEST
UNKNOWN, Proteon Associates Inc., *Waltham, Massachusetts* 02154 (055569 (TRAIS NO.))

The objective of this procurement is to provide technical assistance to the Transportation Systems Center (TSC) in performing laboratory and field experiments directed toward characterizing the behavior of a VHF Data Link System in the presence of such environmental factors as noise and multipath. The system configurations to be investigated will include both the airborne mode and the ground taxiing mode.

Document provided to S.S.I.E. by the T.R.A.I.S.

SUPPORTED BY U.S. Dept. of Transportation - Off. Sec.

4.0007, FABRICATION OF INSTRUMENTED MODEL PARACHUTE CANOPIES
H.G. HEINRICH, Univ. of Minnesota, School of Engineering, *Minneapolis, Minnesota* 55414 (F33615-75-C-0020)

Unsuccessful tactical air drop operations with injuries to personnel and loss of military equipment have been experienced as a result of structural damage sustained by parachute canopies during the opening phase. Structural damage was encountered due to the inability to predict stresses experienced in the canopy cloth for specific operating conditions. The objective of this effort is to acquire model parachute canopies instrumented with stress sensors to be used in an experimental test program for the determination of canopy stress distributions during the dynamic and steady state phases of parachute operation.

Model parachutes of the solid cloth and ringslot type and a series of cloth stress sensors will be fabricated. The stress sensors will be attached to canopy surfaces at given locations and statically calibrated. Services for the data acquisition phase will be provided.

Supporting agency address information: AF Flight Dynamics Laboratory FER, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0008, AEROELASTIC RESPONSE OF PANELS
J.E. YATES, Aeronautical Res. Associates, *Princeton, New Jersey* 08540 (F44620-75-C-0010)

New designs of Air Force flight vehicles require improved understanding of the interaction between external structure and the fluid environment. This research project, utilizing the previously developed boundary layer integral equation theory, will investigate the response of airfoil trailing edges and acoustic panel response. In particular, the trailing edge response will be studied in the incompressible flow regime and in the compressible subsonic flow field. Boundary effects will be investigated in the transition region between the panel boundary layer and the trailing edge wake. This project will also study the problem of acoustic panel excitation and the boundary layer influence on panel response attenuation or magnification.

Supporting agency address information: AF Office of Scientific Research NA, 1400 Wilson Blvd., Arlington, Va. 22209

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0009, CHEMICAL LASER DIAGNOSTICS
J. WAYPA, U.S. Air Force, Weapons Laboratory, *Albuquerque, New Mexico* 87117

To establish a small-scale, highly versatile, chemical laser test device which will be employed to test and analyze advanced mixing/premixed-initiation concepts via the development and implementation of a second generation of optical flow diagnostics.

The subsonic test position at Bldg 617, KAFB West will be modified to allow implementation of a large variety of advanced mixing/premixed schemes and to make it amenable to utilization of optical flow diagnostics. A chemiluminescence diagnostic capability will be established, complemented by a Raman spectroscopy diagnostic tool having the potential of providing a direct measurement of vibrationally and rotationally resolved local specie concentrations including the ground state HF/DF. Baseline tests will be performed on a small-scale cl-v nozzle array leading into a detailed critical examination of more advanced mixing/premixed concepts.

Supporting agency address information: AF Weapons Laboratory ALD, Kirtland AFB, N. Mex. 87117

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0010, ADVANCED VOICE DEMODULATOR
UNKNOWN, Bell Aerospace Company, *Buffalo, New York* 14240 (055610 (TRAIS NO.))

This specification defines an advanced modulator/demodulator to be used with L-band systems. The advanced modem is to provide simultaneous voice and digital data communications to commercial aircraft and ships via satellite. The modem is to be developed to provide the most advanced designs available for simultaneous transmission on a common L-band carrier of voice and digital data signals. The advanced modem is to include a ground based modulator and an airborne shipborne demodulator.

Document provided to S.S.I.E. by the T.R.A.I.S.

SUPPORTED BY U.S. Dept. of Transportation - Off. Sec.

4.0011, INDEPENDENT ALTITUDE DETERMINATION
J.W. GRESS, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433

Presently, no method exists for providing slant range to the pilot during a low visibility approach. The objective is to develop hardware which will provide to the pilot slant range and time to touchdown during low or zero visibility approaches. By knowing the distance to touchdown, the pilot has an independent technique for evaluating the progress of the approach. The altitude system must be independent of ground aids and other basic aircraft systems.

The approach is to develop an interferometer technique using the reflected approach/landing radar signal to determine the slant range; then using the aircraft's airspeed, time to touchdown can be calculated. This technique is to be developed and built by the contractor and evaluated by Air Force personnel on Nc-141a, No. 61-2775.

Supporting agency address information: AF Flight Dynamics Laboratory FGS, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0012, LOW COST CREW STATION COMPONENTS
G.H. MYCROFT, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433

The objective of this program is to exploit the latest technology and latest innovative approaches to display mechanization for the purpose of reduced acquisition cost, improved survivability, reduced vulnerability, reduced maintenance, extended life, and reduced life cycle costs as applied to all Air Force aircraft. This effort is intended to produce a series of simplified display design concepts which will be documented, including trade-off study results, and which will serve as guides to display and aircraft cockpit designers.

New materials and display techniques will be investigated which appear to offer promise in terms of basic cost saving and survivability characteristics. Specific cockpit displays, such as attitude director indicators, and other flight and engine instruments will be selected as candidates for study. Power reduction and weight reduction will also be important factors in the trade-off process. Various materials and devices, such as fiber optics bundles, will be necessary in the in-house development of the candidates, and will be purchased for laboratory experimentation.

Supporting agency address information: AF Flight Dynamics Laboratory FGR, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0013, LOW COST MOBILE REMOTELY PILOTED VEHICLES (RPV'S) LAUNCH SYSTEM - DEVELOPMENT
K.P. SCHWARTZ, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433

Current cost estimates for rocket assisted take off (RATO) launches of drones and advanced remotely piloted vehicles (RPVS) are high and range from $5,000 to $15,000 per launch. In addition, with a RATO launch system, penalties exist such as logistics, dispersal limitations, alignment and assembly problems, and overall RATO reliability. The objective of this program is to develop a ground-based, powered mechanical launch system which is tactical in nature and can be utilized for drones and RPVS of up to 11,000 lbs requiring up to 250 knots of takeoff speed. The payoffs attained will be greatly reduced launch costs and improved systems mobility and reliability.

Existing non-tactical launch concepts will be studied in conjunction with past approaches to naval catapult design. Basic energy requirements will be outlined and general hardware needs will be developed for specific launcher types. Trade-off studies will be conducted to determine the optimum launch system.

Supporting agency address information: AF Flight Dynamics Laboratory FEM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0014, OPTIMAL ESTIMATION AND CONTROL OF DYNAMIC SYSTEMS
W.G. VOGT, Univ. of Pittsburgh, School of Engineering, *Pittsburgh, Pennsylvania* 15213

This research investigates basic mathematical theory and its applications to digital simulation of demand actuated systems. This calls for a concentration of effort in six areas of basic research, all having important consequences regarding the operation of demand actuated systems on large scale networks. The six areas included are (1) effective large scale network partitioning and dealing with large scale networks containing some time varying parameters: (2) to devise a large scale network identification and parameter updating theory; (3) to investigate a means for successfully interfacing different types of transportation systems constrained to networks; (4) to obtain a means of obtaining minimum variance estimates for vehicle positions, pick up times and delivery times; (5) to investigate better assignment methods of demand servicing; (6) to effectively approximate large scale networks for real time control.

SUPPORTED BY U.S. Natl. Science Foundation

4.0015, EDGE FUNCTION METHOD OF STRUCTURAL ANALYSIS
P.M. QUINLAN, Natl. University of Ireland, *Cork, Republic of Ireland* (AF-AFOSR-2768-75)

AF function - structural design/analysis of aerospace vehicles. Deficiency - present inability to mathematically represent large structural sections in an efficient, inexpensive fashion. Present detailed analysis methods are applied primarily to structural details, areas of high stress concentration, etc. Research - Prof. Quinlan is currently developing the edge function method for boundary value structural analysis problems. In addition to his own research, he has access to data from other agencies and institutions on the application of the edge function method to specific areas such as vibration, thick plate, and fracture problems. How research contributes - could provide an alternative, and much less costly, method of mathematically describing complex, large scale, structural assemblies.

Mathematical parameters for the edge function method will be defined. Conditions under which the method can be applied will be obtained.

Supporting agency address information: European Office of Aerospace R & D NRE, Box 14, FPO New York, N.Y. 09510

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0016, REDUCING NOISE LEVELS OF TURBOFAN & TURBOJET AIRCRAFT
UNKNOWN, Univ. of Tennessee, Space Institute, *Tullahoma, Tennessee* 37388 (036321 (TRAIS NO.))

Study of feasible methods for reducing the noise levels of turbofan and turbojet aircraft.

Document provided to S.S.I.E. by the T.R.A.I.S.

SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

4.0017, STABILITY OF CONTROL SYSTEMS
L.G. CLARK, Univ. of Texas, School of Engineering, *Austin, Texas* 78712

Study and determination of methods of analysis as applied to stability of control systems. Considers Liapunov stability in conjunction with optimization. Also, to determine methods of analysis and meaning of sensitivity as related to control.

SUPPORTED BY No Formal Support Reported

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production And Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, METASTABLE PARTICLES OF ATMOSPHERIC IMPORTANCE
J.R. SHERIDAN, Univ. of Alaska, Geophysical Institute, *Fairbanks, Alaska* 99701

Cross sections for reactions involving short-lived metastable species of atmospheric importance will be measured as a function of the velocity of the colliding particles. The technique involves photometric observations of excited metastable states formed in a molecular beam. Reactions of O(1S) atoms with atmospheric constituents will be studied.

SUPPORTED BY U.S. Natl. Science Foundation

5.0002, INVESTIGATIONS OF PARTICLE BOMBARDMENT OF THE POLAR ATMOSPHERE
R.R. BROWN, Univ. of California, School of Letters, *Berkeley, California* 94720

This grant provides further funding for analysis of x-ray, riometer, and other data obtained during a series of balloon flights in 1971 and 1972. The aim is to examine the spatial and temporal features of the electron precipitation events associated with auroral substorm activity, sudden commencements, and sudden impulses in the geomagnetic field. Support is also made available for flight of 16 additional balloon borne x-ray detectors remaining from the previous years. These will be flown as parts of cooperative programs in which electric fields or very low frequency radio emissions will be measured simultaneously.

SUPPORTED BY U.S. Natl. Science Foundation

5.0003, OPERATION AND COORDINATION OF THE CHATANIKA INCOHERENT-SCATTER FACILITY - III
M.J. BARON, Stanford Research Institute, *Menlo Park, California* 94025

This action supplies National Foundation's share of the operating costs of the incoherent backscatter radar facility in Chatanika, Alaska. It permits Stanford Research Institute investigators to make use of this facility for a wide variety of studies of the auroral ionosphere.

SUPPORTED BY U.S. Natl. Science Foundation

5.0004, ANALYSIS OF MICROWAVE SPECTROHELIOGRAMS
R.N. BRACEWELL, Stanford University, School of Engineering, *Palo Alto, California* 94305

A series of 9.1 cm microwave spectroheliograms now exists for the years 1964-1973 in uniform format on magnetic tape, and will be used to study the lower corona and chromosphere, a stratum of the sun that is the origin of important effects on the immediate environment of the earth, especially the upper atmosphere.

SUPPORTED BY U.S. Natl. Science Foundation

5.0005, SOLAR JIC-3 COMBUSTOR DEVELOPMENT FOR BASELINE GAS TURBINE ENGINE
D.J. WHITE, Internat. Harvester Company, *San Diego, California* 92101 (72P20305)

The objective of this contract is to develop a low emission combustion system and hardware suitable for installation and subsequent demonstration in the AAPSDD Baseline Gas Turbine Engine. Accordingly, the Contractor shall provide all necessary manpower and facilities to design, fabricate, and rig-test a low-emission combustor, in accordance with the goals of the prototype Vehicle Performance Specification, dated January 3, 1972. (Attachment A-1) and in coordination with the Baseline Gas Turbine Engine Contractor. This combustor is to incorporate the design concepts of the solar JIC-3 low emission combustor developed under the previous Contract No. 68-04-0016 for the Environmental Protection Agency. The goals are to achieve emissions which are at or below one-half of the 1976 Federal Emission Standards.

SUPPORTED BY U.S. Environ. Protect. Agency - O.R.M.

5.0006, KINETIC EVOLUTION OF GASES
J.C. STEPHENSON, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Boulder, Colorado* 80302

There has been considerable interest in determining the effect of SST's on the atmosphere with regard to a degradation of UV absorption capability through the depletion of ozone in the stratosphere. In order to develop predictive models, various chemical reaction rates involving ozone must be measured. One of these reaction rates involving NO will be measured before this project is transferred to Gaithersburg during the first quarter of FY 75.

Objectives: Measure chemical reactivity CO2 of vibrationally excited NO in collisions with O3.

Progress: TEA lasers and frequency doubling crystals work reliably. Studies of excitation of NO(v equals 1) and NO(v equals 2) states have been completed and published.

Approach: The approach developed by Braun, Kaldor, and Kurylo at NBS-Washington will be used but NO(v equals 1) is pumped instead of O3(001). A frequency doubled CO2 TEA laser optically pumps of NO(v equals 1) state in a flowing mixture of NO and O3. Enhanced visible chemiluminescence from product NO 2 gives the rate constants for the reaction NO(v equals 1) plus O3 yields NO2 plus O2.

Expected results: The rate of the reaction NO(1) plus O3 yields NO2 plus O2 will be measured during the first quarter.

SUPPORTED BY U.S. Dept. of Commerce - N.B.S.

5.0007, FUNDAMENTALS OF PLASMA TURBULENCE
M.S. UBEROI, Univ. of Colorado, School of Engineering, *Boulder, Colorado* 80302 (AF-AFOSR-1908-70)

This effort is conducting research that will contribute to the formulation of a precise physical description of turbulent plasmas. Aspects of this phenomenon have relevance to many areas of air force interest including the development of various simulation, MHD, and laser devices, the modeling of reentry plasma, and the elucidation of turbulent ionospheric processes. The primary objective of this research is to create a turbulent plasma flow, determine its gross characteristics, and subsequently study its turbulent transport parameters. Specifically, this effort will investigate the turbulence created by a drift instability in the positive column of a glow discharge, which is similar to the turbulence expected in geophysical plasmas and high altitude wakes. The measured discharge characteristics will be compared with theoretical predictions based upon macroscopic theories. When a satisfactory fully turbulent state has been attained experimentally, the diffusion and electrical conductivity parameters will be measured and compared with the statistical theories of plasma turbulence. The properties and behavior studied here should be capable of generalization to turbulent plasmas of significant practical interest.

Supporting agency address information: AF Office of Scientific Research NPP, 1400 Wilson Blvd., Arlington, Va. 22209

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0008, INVESTIGATION OF IONIZING RADIATIONS AND THEIR EFFECTS ON THE MIDDLE ATMOSPHERE
J.R. BARCUS, Univ. of Denver, School of Arts, *Denver, Colorado* 80210

The Principal Investigator has accumulated hundreds of hours of balloon-borne measurements (in the 30 to 40 km region) of the intensity and spectrum of X-rays and gamma rays and penetrating charged particles. Charged particle and X-ray data from rocket flights provide information about the region up to 100 km. The data will be analyzed to learn about the influence of 1) magnetospheric electron precipitation and associated bremsstrahlung radiation, and 2) solar proton bombardment and associated nuclear gamma radiation on the mesosphere (90 to 50 km) and atmosphere. This will be accomplished by determining the resultant modifications in the ambient distribution of 1) electrical conductivity, and 2) atomic oxygen and ozone. The purpose is to delineate representative electrical conductivity profiles and realistic horizontal structure. These distributions will be used to establish 1) the range of the magnitude, and 2) the frequency of occurrence of electric field variations due solely to changes in conductivity. They will also be used to estimate the ozone budget modifications caused in the lower mesosphere and upper stratosphere by penetrating photonic radiation and to explore the effects of such changes on other physical and chemical processes in the polar atmosphere. The program entails no field expedition; other data collection may be a logical follow-on.

No antarctic field work is planned.

SUPPORTED BY U.S. Natl. Science Foundation

5.0009, DISTRIBUTION OF HNO3 IN THE STRATOSPHERE
D.G. MURCRAY, Univ. of Denver, Denver Research Institute, *Denver, Colorado* 80210

This represents the final supplement to this grant with funds transferred from the Department of Transportation to support this CIAP effort. This research involves the construction and use of an infra-red spectrometer system WB-57 aircraft.

SUPPORTED BY U.S. Natl. Science Foundation

5.0010, MEASUREMENT OF CROSS SECTIONS OF IMPORTANCE IN THE UPPER ATMOSPHERE
B. VANZYL, Univ. of Denver, Graduate School, *Denver, Colorado* 80210

Laboratory measurements required to interpret observed atmospheric phenomena in the auroral and polar-cap regions will be carried out. Cross sections for ionization and excitation of fast hydrogen atoms, the major component of the 'proton' flux that bombards the earth's atmosphere, will be determined for collisions with prominent atmospheric constituents. Measurements

will focus on the collision energy range below 5 keV, an important range for auroral processes, but one for which only limited cross section data are currently available. Generation of the fast hydrogen atom beam will be accomplished by photodetachment of negative hydrogen ions (H-). This procedure, yielding only ground electronic state atoms for the photon energies employed, lends itself to a simple but highly accurate determination of the magnitude of the neutral beam flux.

SUPPORTED BY U.S. Natl. Science Foundation

5.0011, NEAR ZONE INVESTIGATION
D. PARDUE, U.S. Army, Harry Diamond Labs., *Washington, District of Columbia* 20310

To investigate phase conditions in the near zone of radiators in acoustic and other fields. Phenomenon that produce very long waves in relation to the distance between orgin and observation points can only be analyzed if the near field phase function is known. This knowledge is of particular importance in the precision measurement of gravitational fields and fields and field disturbances.

Experimental and theoretical investigations will be made on acoustic as well as electric radiations.

Supporting agency address information: AMC Harry Diamond Labs, Washington, D.C. 20438

SUPPORTED BY U.S. Dept. of Defense - Army

5.0012, FAR UV MEASUREMENTS AND CALIBRATIONS
D.L. EDERER, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234

The synchrotron ultraviolet radiation facility (SURF) was used as an absolute source to calibrate a NRL-Calrock spectrometer for the ATM mission and an AFCRL aeronomy rocket. SURF was also used to extend Al2O3 photodiode calibrations to 200A, and faster, pure metal photocathodes were studied. A UV hazard meter and several diodes were calibrated for NIOSH in the region 2000-300A. Thirty detector calibrations were performed in the 600-2500A region. Reflectivity of gold was measured between 500A and 170A. Barium absorption spectrum was measured between 520-620A and 100-160A and work begun on UV absorption by excited atoms. SURF-I was shut down to prepare for SURF-II in May 74 and preparation of new beam lines got underway.

Objectives: To give support and guidance to the national measurement systems that require utilization of photons in the far UV spectral region. In FY-75 we will be concerned with preparing SURF-II as a facility of maximal use to NBS and the nation for radiation studies, specifically to develop its capability for far UV radiometry. Also the apparatus designed for the study of optical properties and photoemission from solids, and that for the study of photoabsorption in gases, will be converted and reactivated. To retain our diode calibration capability in the 600-2500A region and maintain a calibration base for the National Institute for Occupational Safety and Health in the 2000-3300A region. To obtain first measurements of far UV absorption from excited sodium atoms.

Motivation: US technology has been developing new techniques which require better measurement capability in the far ultraviolet. Consider: (a) the use of high temperature devices (plasmas) in the search for new energy sources; (b) miniaturization of circuits--requiring the highest possible resolution; (c) far UV as a diagnostic tool to study surfaces and solids of importance to the electronic and chemical industries; (d) the industrial potential of far UV lasers--especially isotope separation and driving of radiation is involved. Thus, to support important national programs and the development of new technologies, we must develop our capability to measure far UV radiation absolutely and develop techniques of manipulating this radiation in various measurement problems. Radiometry is essentially for aeronomy, solar physics, the diagnostics of CTR plasmas, etc. (Text Abridged)

SUPPORTED BY U.S. Dept. of Commerce - N.B.S.

5.0013, STRUCTURE OF TURBULENCE
F.N. FRENKIEL, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234

The measurement of the properties of turbulence in isotropic and nonisotropic turbulence fields has important applications to a myriad of technological and scientific problems. Recently, the study of small- scale intermittency and its relation to the existing theories of the turbulence structure in the atmosphere was extended to include additional results. Progress was also made in developing techniques for the simultaneous measurement of the turbulent velocity components. The investigation of turbulence properties will continue with an immediate task, the completion of a paper on the small-scale turbulence structure.

Objective: To develop and devise measurement techniques incorporating analog and digital methods for the measurement of the statistical properties of turbulence, and to provide significantly new data which will extend our knowledge of turbulent processes.

Motivation: Turbulence is a phenomenon of great complexity and difficulty but also one of great technological and scientific importance. It not only is a significant factor in such problems of national concern as air and water pollution, noise and energy, but also has an important bearing on many problems in aerodynamics, hydrodynamics, meteorology, and industrial processes, to name just a few. Existing results and ideas have to a large extent been related to experimental measurements, & more particularly to measurements made in wind tunnels. A large body of knowledge has been developed but there is a need for significantly new data, new physical ideas, simplifying assumptions & more powerful methods. This program continues the NBS work on the development and application of its measurement capability to the solution of important fluid mechanic problems.

Approach: The microstructure of turbulence will be investigated using hot-wire instrumentation and high-speed computing methods. Analog recordings of turbulent data are made on multi-channel magnetic tape for a turbulent field established in the NBS wind tunnel. The analog data is digitized & analyzed at NSRDC. Both isotropic and anisotropic turbulent fields will be studied. Special emphasis will be given to the small-scale turbulence structure, & to the flow near the surface in a turbulent boundary layer. Long-range plans include the influence of free-stream turbulence & roughness on the structure of turbulence in the boundary layer, & the extension of similar studies to wakes & jets. (Text Abridged)

SUPPORTED BY U.S. Dept. of Commerce - N.B.S.

5.0014, DEVELOPMENT OF TECHNIQUES FOR DETERMINING DENSITY & WIND PROFILES OVER SILENT AREAS FROM SATELLITE INFRARED OBSERVATIONS
G. OHRING, Tel Aviv University, *Tel Aviv, Israel* (DA ERO 126 74 G0057)

Project will evaluate feasibility of deriving atmospheric density and wind profile for silent areas directly from satellite measured earth atmospheric infrared emission spectra.

Approach: Utilize statistical technique based upon the derivation of specification equations relating atmospheric densities and wind to satellite spectra. The satellite spectra can be either the IRIS (infrared interferometer spectrometer) or the SIRS (scanning infrared spectrometer) data. Highly relevant to: mission and internal research of Desert Test Center and Atmospheric Research Lab (WSMR) for 'silent areas' in which only satellite data are available- prediction of nuclear fallout- artillery and rocket firings- and global weather prediction models.

Supporting agency address information: OCRD European Research Office, Box 15, FPO, N.Y. 09510

SUPPORTED BY U.S. Dept. of Defense - Army

5.0015, STRATOSPHERIC MEASUREMENTS OF PARTICULATES
H.A. MIRANDA, Epsilon Laboratories Inc., *Bedford, Massachusetts* (F19628-74-C-0078)

AF function - reconnaissance, communications, surveillance, guidance, target acquisition and tracking. Deficiency - the performance of optical systems observing through the atmosphere is significantly degraded by light scattering and absorption and is a variable complex function of the atmosphere in the theater of operation. Research - balloon-borne measurements of atmospheric haze particle concentration and size up to 30 km altitude. How

research contributes - these experiments will provide direct measurements of atmospheric input parameters for computer programs utilized for the prediction and analysis of atmospheric optical effects on various optical and electro- optical systems under operational use. Novel devices have been designed, fabricated, and flown to measure the size distribution and concentration of haze particles from ground level to 30 km altitude. Results from these flights will provide direct input data needed for evaluating the accuracy of theoretical computation methods on light transport. Such theoretical programs are important for the calculation of atmospheric optical effects on specific electro-optical systems under given operating conditions.

Supporting agency address information: AF Cambridge Research Laboratories OP, L. G. Hanscom Field, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0016, POLAR ENERGY INPUT MECHANISMS

W.N. HALL, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts*

AF function - the research will be used to AFTAC in calculating theoretical and laboratory experimental determinations of fluorescence efficiencies. Also research advancements have been identified by ESD as important to future generation AABNCP and AWACS systems. Deficiency - experimental measurements in a real atmosphere are needed to test laboratory and theoretical determinations of fluorescence efficiencies. Objective - to gather data in a real atmosphere and use these data to determine in situ fluorescence efficiencies. In FY75, the objective is to build a data base from which the in situ fluorescence efficiencies of ionized molecular nitrogen first negative and Meinel bands can be determined, and to develop analysis methods which can be used to obtain the desired information. How research contributes - provides the data necessary for testing laboratory and theoretical determinations of fluorescence efficiencies.

A dual channel scanning spectrometer system will be installed at the AFCRL Geopole Observatory, Thule, Greenland to simultaneously monitor the 3914A first negative band and the 7852A Meinel band of ionized molecular nitrogen produced during the precipitation of MeV solar protons in the polar cap during a solar particle event. Software packages will be developed on the AFCRL CDC computer system to reduce and do preliminary analysis of the data. Results will be compared and correlated with satellite particle measurements to determine the in situ fluorescence efficiencies for the ionized molecular nitrogen first negative and Meinel bands in the polar cap upper atmosphere. Sixteen years of patrol spectrograph film data from the AFCRL Geopole Observatory will be reduced, calibrated and made compatible with the AFCRL CDC 6600 computer to analyze the data in order to determine the range of the natural variation of the 3914A band intensity during a solar cycle, as well as its disturbance characteristics.

Supporting agency address information: AF Cambridge Research Laboratories PH, L. G. Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0017, EFFECTS OF THE GULF STREAM MEANDERING ON THE LOW-FREQUENCY VARIABILITY OF THE CURRENTS ALONG THE CONTINENTAL RISE

J.R. LUYTEN, Woods Hole Oceanographic Inst., *Woods Hole, Massachusetts* 02543

The energetic meandering of the Stream is suspected as source of much of the low frequency variability in the western North Atlantic. The possible radiation of energy from the Stream as topographic waves may play an important role in the dynamics of the Gulf Stream and the rings cast off from the Stream. This study will investigate the space and time scales of flow in the region along the continental rise between the Gulf Stream and the continental slope, in the vicinity of 70 degrees W. The proposed field program will be carried out in conjunction with an array of moored current meters spanning a rectangular region between Site D (39 degrees 10'N, 70 degrees 00'W) and the Gulf Stream (37 degrees 30'N, 70 degrees 00'W). The principal objective of the field work is to determine the motion of the Gulf Stream in this region over a period of nearly three months. This work will involve a series of 15 aerial surveys of the surface temperature gradient associated with the Stream, and several detailed surveys of the near-surface expression of the velocity core (15 degrees isotherm at 200-m depth, denoted T15) from a ship. In addition, the study will attempt to determine the vertical structure of the horizontal velocity field in three locations, within the Stream (near T15), in the wings of the current (20 km shoreward from T15) and in the asymptotic region of the Stream: the order of 75 km shoreward from T15. These profiles will be obtained from time series of observations with the acoustic dropsonde. The shipboard work will require a total of 30 days.

SUPPORTED BY U.S. Natl. Science Foundation

5.0018, LATITUDE DEPENDENCE OF ATMOSPHERIC DENSITY

R.E. KELLY, Univ. of Mississippi, School of Liberal Arts, *University, Mississippi* 38677

This project is continuing (unfunded) and has been joined by James E. Hendrix. The object is to determine an approximate equation for the latitude variation of mean annual atmospheric density suitable for use in mathematical developments when numerical methods are to be avoided. The quation is expected to be resonably short, passess continuous derivatives and be expressed in terms of well-known functions.

SUPPORTED BY University of Mississippi

5.0019, HYDROLOGY OF SUBURBAN AREAS

K. NATHAN, Rutgers the State University, Agricultural Experiment Sta., *New Brunswick, New Jersey* 08903 (NJ00571)

Objective: Compare water balances of small watersheds occupied by properly managed farms and/or woods to those of matched watersheds occupied by suburban developments; determine practices which will best contribute to proper conservation of existing water and soil resources in agricultural areas undergoing suburban development.

Approach: Rainfall will be measured in a network of standard gauges. Evaporation will be determined with standard pans. Elevations of water table will be recorded with observation wells and stage recorders. Runoff will be determined in appropriate locations by standard flumes. Stream flow will be determined and recorded by electric velocity probes and current meters and standard hydraulic procedures. Soils will be sampled and moisture contents determined periodically by standard methods. Records of temperature and relative humidity will be kept.

Progress: The collection of rainfall and runoff data on the experimental watershed was continued by means of two digital precipitation gages and two digital stream gaging stations, all with punched paper tape output at five-minute intervals. Surveillance of land use was maintained by aerial photography. There has been a great amount of building activity including high rise and townhouse construction on the watershed. Stream flow records are made available to the U. S. Geological Survey and are published in the annual report 'Water Resources Data for New Jersey - Surface Water Records' under Stations No. 4025.9, Royce Brook Tributary at Frankfort and No. 4026, Royce Brook Tributary near Belle Mead.

SUPPORTED BY New Jersey State Government - Trenton

5.0020, INVESTIGATION OF PLANETARY-SCALE FLUCTUATIONS OF THE ATMOSPHERE

R.J. DELAND, Polytechnic Inst. of New York, School of Science, *Brooklyn, New York* 11201

The objective of this research is to analyze the structure of planetary-scale pressure and temperature fluctuations in the stratosphere and mesosphere using (1) conventional isobaric data, and (2) NIMBUS IV and V infrared Spectrometer (SIRS and ITPR) and Selective Chopper Radiometer data, for characteristic times of a few days.

The data will be subjected to zonal Fourier analysis and the resulting harmonics analyzed by cross-correlation and temporal spectral analysis techniques.

Energy transports and conversions related to the planetary-scale fluctuations, including the associated variable flux of energy into the ionosphere, will be calculated from the results of the statistical analyses.

The time-delays of fluctuations at higher levels relative to those at lower levels, which may be associated with the finite speed of upward propagation of transient disturbances, will be estimated using correlation analysis.

SUPPORTED BY U.S. Natl. Science Foundation

5.0021, LOW REYNOLDS NUMBER FLOW IN MULTIPARTICLE SYSTEMS

R. PFEFFER, City University of New York, School of Engineering, *New York, New York* 10031

Analytical, numerical and experimental studies will be made to solve problems in creeping flow past assemblages of particles. They entail the following aspects: (1) Extension of the multipole truncation technique for unbounded quasi-steady state flows to the problem of (a) unsteady motion of a chain of three spheres falling in an infinite viscous fluid, (b) steady axisymmetric viscous flows relative to finite chains of spheres and spheroids in a cylindrically bounded medium, and (c) the unsteady motion of a finite chain of spheroids moving freely in a bounded medium, including a study of how rouleaux of red blood cells form in capillary flow. (2) Experimentation to verify the results of the above investigations and also determine the upper limit of the range of Reynolds numbers for which the coaxial motion of a chain of particles in a viscous fluid remains stable. (3) Extension of the low Reynolds number theory to flows in which the Reynolds number is greater than the Stokes limit but less than the limit for axisymmetric stability determined in the above mentioned experimental research. (4) Development of a method similar to the multipole truncation technique to be able to examine non-axisymmetric flow relative to assemblages of spherical particles.

SUPPORTED BY U.S. Natl. Science Foundation

5.0022, ATOMIC AND MOLECULAR PROCESSES IN ATMOSPHERIC ENVIRONMENTS 11427-P

W.L. FITE, Univ. of Pittsburgh, School of Arts, *Pittsburgh, Pennsylvania* 15213 (DAHC04-73-C-0037)

To study particulate technology. New means have been discovered to electrically detect and count very small particles. It is proposed that an effort be made in order to improve this technology and explore its application to ARPA problems. Particular points to be investigated include determination of sensitivity of the method, variations of the actual apparatus for use in the laboratory and consideration of its use to fly in rockets to determine normally occurring particulate matter in the D-region of the upper atmosphere.

Plume physics: It is known that particulate matter is ejected from rocket engines and the method may prove to be a valuable diagnostic method in understanding plume physics. Extremely little is known about naturally occurring particles, possibly fed into the atmosphere by meteoritic activity, and the method may be adaptable to allowing direct rocket experimentaion.

Supporting agency address information: AMC Army Research Office ARO-D, Durham, N.C. 27706

SUPPORTED BY U.S. Dept. of Defense - Army

5.0023, STUDY OF NEAR INFRARED PROCESSES IN THE AURORAL REGION

K.D. BAKER, Utah State University, School of Engineering, *Logan, Utah* 84321

This supplement to grant GA-38794 increases the support and extends the duration of the grant. It allows further field work, data analysis of the field results, and includes the related work of a graduate student.

SUPPORTED BY U.S. Natl. Science Foundation

5.0024, STUDIES OF THE PATTERN AND AGES OF POST-METAMORPHISM FAULTS IN PART OF THE NORTHERN PIEDMONT (VIRGINIA AND NORTH CAROLINA)

L. GLOVER, Virginia Polytechnic Institute, School of Arts, *Blacksburg, Virginia* 24061 (AT(40-1)-4802)

Compile known faults and search for new ones, particularly those younger than the (ca. 350 m.y.) Paleozoic metamorphism, that show only minor annealing. Date the ages of fault movement by means of isotope geochemistry applied to fault gouge and mylonite. Investigate the applications of isotope geochemistry to the dating of soil formation, because soils are the youngest geologic units cut by faults. This study will provide regional geologic information needed for targeting conventional and atomic power plant sites. The procedure involves compilation on 1:250,000 AMS 2 degrees base of known faults and lineations and searching for new ones using: ERTS photography, topographic maps, conventional air photos, airborne magnetic survey maps, existing geologic maps and field reconnaissance data. Detailed field studies of selected areas will be started during the second year. The Hylas mylonite zone, northwest of Richmond, Va., will be mapped and studied to determine its origin and age. A geologic strip map along the James River between Columbia and Richmond will be prepared to search for possible effects of recent fault movement in this zone of more active seismicity. K-Ar and Rb-Sr isotopic studies will be used to date mylonite. Pb-U isotopic studies of zircons will be used to date the first leaching of zircons as they are exhumed by weathering and brought into the zone of saprolitization and soil formation. The region of study encompasses the northern Piedmont between the latitude of Fredericksburg, Va. and a line parallel with the Haw River in North Carolina.

SUPPORTED BY U.S. Atomic Energy Commission

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, COGNITIVE PRETRAINING OF THE T-37 OVERHEAD PATTERN

J.A. FITZGERALD, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224

To develop, test, and evaluate a cognitive pretraining approach to more efficiently train undergraduate pilot training students for the T- 37 overhead pattern.

A mediated program derived from a detailed maneuver analysis will be developed. The program will include the following elements in sequence- programmed text augmented by 35mm color slides, short super 8 color film sequence of the pattern, 35mm color slide sequences of the pattern, and one or more practice missions in the T-4g simulator. The program will provide for criterion tests at each stage, for proficiency advancement up to but not including flight phase training, and for remedial training on earlier training elements when appropriate. The instructional produce will be administered in two phases. Phase I will be a tryout on a small sample to obtain data for revision. Phase II will be a controlled application to a randomly-selected sample of UPT student pilots immediately prior to introduction of these students to flight phase training. Performance of the experimental group will be compared to the control group on the basis of trials (not including demonstrations) to reach a level of performance considered safe to solo.

Supporting agency address information: AF Human Resources Laboratory, Ft. Williams AFB, Arizona 85224

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0002, ELECTROPHORETIC SEPARATION OF CELL POPULATIONS

M. BIER, U.S. Veterans Administration, Hospital, *Tucson, Arizona* 85713

This project is an outgrowth of a Nasa sponsored Research Contract on 'Role of Gravity in Preparative Electrophoresis', administered through the University of Arizona. The aim of the Nasa contract is to develop an improved apparatus for electrophoretic fractionation at zero gravity, i.e., in orbiting

spacecraft. As part of this contract, electrophoretic devices were flown in Apollo XVI (1) and in Skylab (2). As a result of the work for Nasa a new type of electrophoretic device has been designed and constructed, which may have significant applications for separation of various biomaterials including living cells here on earth. This aspect of the Nasa work is now being continued under VA auspices. The main motivation for this work is that there is urgent need for simple devices which will permit electrophoretic separation of living cells, such as lymphocytes, bone marrow cells, etc. Work is also continuing under the parallel Nasa contract (3), which is being funded at a rate of $75,000 for the present fiscal year. Its immediate objective is the participation in an international electrophoresis experiment on board of the forthcoming Apollo-Soyuz space flight.

SUPPORTED BY U.S. Veterans Administration

6.0003, APPLIED PHYSICAL ANTHROPOLOGY FOR DESIGN OF AF SYSTEMS
M. ALEXANDER, U.S. Air Force, Aerospace Med. Res. Lab., *Dayton, Ohio* 45433

This work unit provides consultancy and guidance for the application of engineering anthropometric data in support of engineers and designers, and aids in the evaluation of the application of these data in end items and systems. Principal areas of work are related to the sizing and design of personal protective equipment for hazardous environments and the integration of the man (fully encumbered pilot) with his work station (cockpit).

Detailed anthropometric data form the basis for guidance in the design, sizing and procurement of clothing and personal protective equipment and for the design and layout of work spaces. These data to be effective must reflect the practical requirements of a design problem and/or end item. Each design task becomes a matter of reanalyzing the existing data, or developing new data as needed, to meet the specific requirements of a particular anthropometric design problem. This effort was formerly included under Work Unit 71840803, 'Anthropometric Design Criteria for AF Systems'.

Supporting agency address information: 6570 Aerospace Medical Rsch. Lab HE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0004, EFFECTS OF HANDLING QUALITIES ON REMOTELY PILOTED VEHICLE (RPV) OPERATOR PERFORMANCE
M.D. CLADER, U.S. Air Force, Aerospace Med. Res. Lab., *Dayton, Ohio* 45433

The objective of this work unit is to develop a human operator model sensitive to the effects of handling qualities on operator performance of remotely piloted vehicles. Handling quality factors will include control station configuration, control system design, and sensor design and operational procedures. This model will be usable by AFAL, AFFDL and the RPV SPO in formulating design criteria for our RPV console control systems and missions.

Data collected from AMRL remotely piloted vehicle terminal phase simulation experiments will be analyzed using control and statistical theory measurement. This analysis will establish the model parameters.

Supporting agency address information: 6570 Aerospace Medical Rsch. Lab EM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0005, HUMAN ENGINEERING APPLICATIONS, CONSULTATION, AND SUPPORT
L.I. GRIFFIN, U.S. Air Force, Aerospace Med. Res. Lab., *Dayton, Ohio* 45433

This Work Unit provides human engineering design consultation, application and support to the numerous directed and requested human performance problem areas referred to Task 718404 for solution. Support is provided at all stages of development including conceptual design, acquisition and test. Current examples of support activities include MIL STD 1472A revision, compass ears, and RPV mission analysis, radar design and operator performance research.

A cadre of experienced personnel is maintained who are responsive to requests for human engineering support from AF development agencies, using commands, and other DOD groups. Assistance is provided in formulating the problem and in its solution. Specific equipment design may be recommended, experimental procedures suggested, specific flight tests recommended, or in-house or contract research may be pursued. Typical problems may require anything from a reference to existing human performance data to several man-years of research.

Supporting agency address information: 6570 Aerospace Medical Rsch. Lab HE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0006, HUMAN ENGINEERING APPLICATIONS, CONSULTATION AND SUPPORT
H.C. SELF, U.S. Air Force, Aerospace Med. Res. Lab., *Dayton, Ohio* 45433

This Work Unit provides human engineering design consultation, application and support at all stages of development including conceptual design, acquisition, and test. Human engineering support is provided the AF by development agencies, U. S. Army, U. S. Navy, NASA, industry and allied Air Forces. Assistance is furnished in formulating the problem and in its solution.

Specific equipment design may be recommended, experimental procedures suggested, specific flight test recommended, or in-house or contract research may be pursued. Typical problems may require anything from a reference to existing human performance data to several man-years of research. Portions of this effort was formerly included under Work Unit 71840435, 'Human Engineering Applications, Consultation and Support'.

Supporting agency address information: 6570 Aerospace Medical Rsch. Lab HE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0007, EFFECT OF LOW LEVEL RADIANT HEAT LOADS ON MISSION RELATED PERFORMANCE
K.A. SMILES, U.S. Air Force, Aerospace Med. Res. Lab., *Dayton, Ohio* 45433

Quantify typical low level radiant heat loads in the cockpit of transparent canopy aircraft, formulate methods for manipulating environmental control specifications to more adequately account for these thermal loads on pilots, quantify the impact of these loads on critical pilot control characteristics and physiological responses. These objectives were formulated from a request by ASD/ENJPC for help in revising military specification MIL-E-38453 on the environmental control system standards for aircraft.

An in-flight lightweight and portable device for adequate measurements of these radiant loads is to be acquired and/or developed and data acquired. Investigations to simulate these loads within the environmental test facility will be undertaken and a systematic series of human experiments performed to fulfill the above objectives. These will entail trained subjects performing simulations of critical pilot tasks during exposure to various radiant loads at several ambient temperatures. The resulting records will be analyzed via human operator identification techniques and incorporated into system effectiveness estimates.

Supporting agency address information: 6570 Aerospace Medical Rsch. Lab EM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0008, ENVIRONMENTAL CONTROL SYSTEM/PILOT PERFORMANCE
K.A. SMILES, U.S. Air Force, Aerospace Med. Res. Lab., *Dayton, Ohio* 45433

To replace current specifications for cockpit environmental control based on gross comfort and tolerance levels with tradeoff parametric criteria that relate thermal factors to optimum performance of the entire manned weapons system. This is to be accomplished varying the amount of engine power diverted to the environmental control system and quantifying the impact on aircraft and pilot performance characteristics. This work unit is in response to a request from ASD/ENJPC. A technology need is in preparation.

Tracking data from Work Units 72220889 and 72220891 will be analyzed via human operator parameter identification techniques to quantify changes in pilot performance characteristics as a function of environmental conditions within the cockpit. This data is to be formulated in several ways thought most feasible for tradeoff studies. The approaches to be tried include nomographs, differential equations, state variable representations, and computer simulations of the various model structures. Interaction with ASD/ENJPC is anticipated to assure applicability for tradeoff studies and systems effectiveness analysis.

Supporting agency address information: 6570 Aerospace Medical Rsch. Lab EM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0009, TOLERANCE LIMITS AND MECHANISMS OF FAILURE OF THE SKELETAL SYSTEM UNDER IMPACT CONDITIONS

G. GRAVES, Univ. of Dayton, Research Institute, *Dayton, Ohio* 45409 (F33615-75-C-5008)

This effort supports in-house research to define the mechanical properties, bone dynamics, failure and tolerance limits of the skeletal system. This allows analysis of the mechanical factors which result in bone fractures and injury to the skeletal system under impact conditions. This includes emergency egress from aircraft, crash and hard landings, and other operational conditions in which large magnitudes of force must be taken by the skeletal system. Information is required to define man's ability to tolerate the mechanical stresses associated with present and future operational Air Force environments.

Analysis of the failure properties and tolerance limits of bone structures will be performed. In vitro skeletal failure conditions of the type which produce human injury are simulated using the primate model. Appropriate scaling laws allow prediction of human skeletal behavior to impact conditions. The mechanical properties of bone structures correlated with histological, physical, and biochemical parameters allow definition of the factors which act to maintain normal bone strength and which define tolerances limits of skeletal structures. This effort has important preventive implications in regard to human injury and is directed towards defining the failure limits to which man may be subjected.

Supporting agency address information: 6570 Aerospace Medical Rsch. Lab BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0010, RADIOFREQUENCY ELECTROMAGNETIC ENVIRONMENT SIMULATION AND MEASUREMENT

S.J. ALLEN, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235

The objective of this work unit is to develop the radiofrequency (RF) radiation simulators and instrumentation required to reproduce AF operational RF environments in the laboratory to support bioeffects studies. The results of such studies will continue to provide the basis for modifying the personnel exposure criteria for AF RF operations.

Instrumentation will be developed to measure E- and H-fields independently and simultaneously at frequencies up to 1 GHz. The instrumentation and theory which will allow complex dielectric measurement in fields of 1 to 10 GHz using six-port theory will be developed. An orthogonal dipole instrument which will measure peak energy density in pulsed RF environments will be developed. A study to compare RF field measuring techniques will be performed in the USAFSAM exposure chambers by USAFSAM/RAP and Keesler AFB (1839 EIGP) personnel. Power absorption studies in the 10-50 MHz region, setup of multiple frequency fields for bioeffects studies and a study to determine potential problems in phased array systems will be completed.

Supporting agency address information: USAF School of Aerospace Medicine RA, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0011, PHYSIOLOGIC SENSING AND CONTROLLING CIRCUITS FOR NEW GENERATION OXYGEN DELIVERY SYSTEMS

F.W. BAUMGARDNER, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235

The performance of oxygen delivery systems must insure adequate physiologic function to users in diverse operational environments. In dynamic operation, current-inventory oxygen systems waste oxygen, exhibit flow limitations, and impose physiologically stressful breathing pressures on the cardiopulmonary system of the user. The overall objective of this work unit is to establish concepts and data for the development of systems which optimize oxygen delivery to aircrews in advanced and conceptual aircraft. The specific objectives are to identify appropriate parameters which will indicate individual oxygen requirements under various flight profiles and degrees of stress, evaluate candidate respiratory parameters and controller inputs for physiologic feedback control systems, and to assess the feasibility of demand-supply matching systems. These efforts are coordinated with AFFDL/FEE and ASD/SML on a continual basis in accordance with letters of agreement, and close technical liaison is maintained with Oklahoma City ALC, ASD/ENCCE, and NADC.

Human volunteer subjects will participate in a series of experiments to determine correlations between physiologic variables such as ventilatory flow, ventilatory pressure, tidal volume, respiratory frequency, respiratory period, inspiratory time, expiratory time, the time derivative of initial inspiratory pressure and flow, and minute ventilation and oxygen consumption. In collaboration with AFFDL/FEE, physiologic data obtained will be used to devise a feedback control circuit which will deliver appropriate oxygen volumes and flows to match physiologic requirements. The circuit will be revised and refined during laboratory experimental use to optimize its functional characteristics. Initial experimental studies will employ human subjects at rest, at ground level and follow-on studies will include subjects at altitude and under varying levels of exercise and environmental stress conditions. Delivery of oxygen as variably-sized bolus volumes, based on sensed requirements, during the early phase of inspiration will be specifically considered as a means of enhancing physiologic compatibility while economizing oxygen use.

Supporting agency address information: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0012, EFFECT OF HIGH ACCELERATION COCKPIT SEAT GEOMETRY ON ACCELERATION TOLERANCE

J.W. BURNS, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235

To determine, both subjectively and objectively, the physiologic effects and responses to various seat back angles (13 degrees through 65 degrees) at high sustained and repetitive (g on g) acceleration exposures. To identify the optimum back angle which will result in operational advantage in air-combat maneuvering. To define safe exposure limits in the tilt-back seat during high sustained or repetitive acceleration in support of advanced fighter-attack aircraft. Major emphasis will be placed on obtaining information from human experiments; however, these studies will be supplemented by additional investigations in experimental animals.

For human experimentation, subjects will be studied both relaxed and while performing protective anti-g straining maneuvers at different seat-back angles and heel positions. Sophisticated instrumentation especially designed for the centrifuge will be used to monitor the electrocardiogram, blood pressure, intrathoracic pressure, oxygen saturation and oxygen consumption to provide information about man's physiologic and operational performance during air-combat maneuvering. Experiments in animals will be designed using invasive chronic instrumentation, to answer those questions which cannot be answered with the use of humans, such as direct instantaneous cardiopulmonary dynamics and function.

Supporting agency address information: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0013, AIRCREW TOLERANCE AND PHYSIOLOGIC PERFORMANCE DURING HIGH SUSTAINED G IN TACTICAL AIRCRAFT
K.K. GILLINGHAM, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235

To determine man's physiologic and pathologic responses and tolerance to gravitoinertial (g) forces encountered during sustained high linear acceleration at the levels to be generated by operational fighter aircraft of the late 1970s and 1980s.

Humans and animals will be exposured to step-functions of acceleratory stress (onset rate of 1 g/sec, plateaus of 30 to 90 sec) and the behavior of a humber of indices of physiologic function and pathologic response will be monitored. In humans, various physiologic and biochemical indicators of stress and fatigue will be obtained from subjects during exposure to acceleratory stress to determine the physiologic effects of the stress, cardiac diagnostic tests, such as vectorcardiograms and maximal treadmill stress tests, will be accomplished on a number of subjects before and after exposure to sustained acceleratory stress to determine the pathologic consequences and define the risks of such exposure. Experimental animals, primarily miniature swine and monkeys, will also be exposured to sustained high g stress, and similar physiologic and biochemical indicators of stress and fatigue will be examined at various amplitudes and durations of high- level g stress. Postmortem examinations of animals subjected to varying degrees of g stress in single and repetitive exposures will be accomplished to determine the etiology and significance of pathologic changes associated with exposure to sustained high g stress.

Supporting agency address information: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0014, OPTIMIZATION OF PHYSIOLOGIC PROTECTIVE MANEUVERS FOR AIRCREW IN A HIGH G ENVIRONMENT
S.B. WILEN, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235

The objective of this effort is to examine the effects of modifying a variety of physiologic parameters--either singly or in combination--on improving (or reducing) plus gz tolerance in human subjects or aircrew members. For example, CO2 breathing and positive pressure breathing appear to improve g tolerance while 100 percent O2 breathing has a deleterious effect. It is not known what the effect will be when a combination of physiologic perturbations is imposed on the aircrew member, i.e., increased CO2 combined with increased temperature and dehydration. This effort is designed to determine the optimum environment in which the fighter pilot should function in order to achieve maximum effectiveness for himself and his aircraft.

The USAFSAM human centrifuge will be used as a controlled simulator for duplicating air combat maneuvering g forces. By monitoring a variety of physiologic parameters such as O2 uptake and CO2 production, blood pressure, heart rate and rhythm, arterial O2 saturation, and others, it may be possible to predict changes in tissue O2 levels during g that will subsequently affect g tolerance. The influence of cumulative g and repetitive g on g on physiologic systems while the subject is experiencing a variety of external changes to his normal environment will be examined. The cardiopulmonary system will be the major area examined for acute and/or chronic changes.

Supporting agency address information: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, COMPUTATION OF THREE-DIMENSIONAL AERODYNAMIC FLOW
K.C. WANG, Martin Marietta Corporation, *Baltimore, Maryland* 21227 (F44620-70-C-0085)

The design of effective aerospace vehicles with external stores which could be released at high speeds and varying angles of attack require the full knowledge of the pattern of the fluid flow around all its parts. At present, various laboratories and centers like the Flight Dynamic Laboratory and the Arnold Engineering Development Center attack the problem from the empirical point of view. The rise of wind tunnels for this purpose provided part of the answers at a very high cost and with a considerable time delay. Full simulation of the problem could reduce the cost and the lead times needed to design new aerospace vehicles. This research effort intends to continue the work in the development of the necessary numerical techniques for simulating the laminar boundary layer of aerospace vehicles wings at different angles of incidences. New routines for calculating the three-dimensional total displacement thickness will be developed. A small effort will be spent in improving the newly developed computer code and then properly documenting it for possible use at the AFSC laboratories.

Supporting agency address information: AF Office of Scientific Research NM, 1400 Wilson Blvd., Arlington, Va. 22209

SUPPORTED BY U.S. Dept. of Defense - Air Force

7.0002, SUPPORT IN THE DEVELOPMENT OF COMPUTER SOFTWARE FOR ATC SIMULATION FACILITY
UNKNOWN, Computer Sciences Corporation, *Falls Church, Virginia* 22046 (038180(TRAIS NO.))

Under this Task Order Contract provide technical assistance and support in the development of computer software programs for use by NAFEC's Digital Air Traffic Control Simulation Facility.

Document provided to S.S.I.E. by the T.R.A.I.S.

SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, EXCITATION OF LYMAN AND BALMER RADIATION IN COLLISIONS OF PROTONS AND H ATOMS WITH ATMOSPHERIC GASES
J. SHERIDAN, Univ. of Alaska, School of Arts, *Fairbanks, Alaska* 99701

Gain detailed information for understanding processes in upper atmosphere, applying data to radio transmission in ionosphere and in nuclear blasts.

SUPPORTED BY University of Alaska

8.0002, EXCITATION OF H2 BY LOW ENERGY ELECTRON IMPACT
R.J. ANDERSON, Univ. of Arkansas, School of Arts, *Fayetteville, Arkansas* 72701

An in-depth study of the electronic excitation of the H2 molecule by low energy electron impact will be carried out. Collisional and radiative excitation processes for the B1 sigma mu plus, C1 pi mu, D1 pi mu, E1 sigma g plus, d3 pi mu states will be investigated. Optical methods will be used to obtain absolute cross sections for transitions between excited electronic states of H2. The contribution of radiative cascade and collisional transfer to the excited state population will be evaluated, and absolute measurements of their magnitude will be obtained. A wide range of experimental conditions will be used to derive maximum applicability of the results in planetary aeronomy.

SUPPORTED BY U.S. Natl. Science Foundation

8.0003, ATOM-MOLECULE KINETICS INFLUENCED BY LASER PUMPING

W. BRAUN, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234

As part of a continuing effort to measure precise rate constants for elementary reactions involving ground state and electronically excited atoms and molecules with substrates of atmospheric and terrestrial interest, we have recently developed a new technique for the measurement of the dynamics of vibrationally excited species produced by infrared laser excitation. This new information is essential to a detailed understanding of reaction rate theory, is important to the understanding of combustion and flame mechanisms, and is applicable to problems of isotope separation, to the modeling of atmospheric and terrestrial systems, and to the development of new visible chemical lasers.

Objectives: To explore the effect of reactant vibrational excitation on gas-phase chemical dynamics and the implications of the observed reaction rate dependence, with respect to the detailed understanding of reaction rate theory & with respect to the modeling of a wide range of complicated processes characteristic of combustion, atmospheric chemistry, & other systems.

Motivation: Reaction kinetics are usually studied under thermally equilibrated conditions. With the recent availability of a multitude of laser systems, it is possible to produce non-equilibrium distributions of a number of reactants, in turn permitting experimental study of the specific effect of internal energy on the reaction dynamics involving these reactants. These studies are important not only because of their significant implications in the development of reaction rate theory, but also because of their potential practical application to problems related to isotope separation, atmospheric and stratospheric modeling, & the development of new visible chemical lasers.

Approach: Modulated radiation from a suitable laser is used to excite vibration in a reactant molecule, & the detection of chemiluminescence or of resonance fluorescence is used to determine the separate rates of reaction of the unexcited and the vibrationally excited molecule with another atom or molecule introduced into the system.

Progress: We have completed a detailed kinetic investigation of the reaction of vibrationally excited ozone, O3 ion, (produced by CO2 laser radition) with NO, producing both vibrationally and electronically excited NO2. In addition, the wavelength dependence of electronically excited NO2 was determined. Vibrational relaxation of ozone by a large number of deactivating gases was measured. (Text Abridged)

SUPPORTED BY U.S. Dept. of Commerce - N.B.S.

8.0004, PLASMA CHEMISTRY

M.D. SCHEER, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234

A stationary, pulsed, electrical discharge apparatus has been designed and built. The transient plasma voltage and current are measured in order to determine the total energy input during the on-time of a low duty cycle (0.1%) pulsing sequence (20Hz). The relaxation of the resulting distribution of the Input pulse energy has been determined during the off-time between pulses (afterglow behavior). In the case of a helium discharge, the metastable triple concentration (two to the third power S), the ion-electron pair concentration, the electron temperature, and the gas temperature were determined as a function of afterglow time. The effect on these parameters of small admixed quantities of other rare gases (Ne and Ar) and simple diatomic molecules (H2, N2, CO, and O2) as well as the rates of chemical change will be studied.

Objective: The objective of this investigation is to determine the chemical behavior of simple gases in an electronically conducting environment of electrons, ions and energetic metastable species.

Motivation: The understanding of the chemical behavior of plasmas is of importance to the fields of high temperature technology, the aeronomy of the upper atmosphere, and nuclear fusion technology. The high temperature and nuclear fusion technologies are gaining importance as the energy problems of our society become more acute. The advance of these technologies in the next decade will be crucial to the solution of problems arising from the projected shortages of energy in modern industrial economies. The upper atmosphere is rapidly rapidly becoming a part of man's domain. As a result, the interactions between electrons, solar photons, ions and electronically excited species with neutral atoms and molecules must be understood in order to bring about the successful neutral atoms and molecules must be understood in order to bring about the successful exploitation of this part of our environment.

Approach: An elegant method for studying plasma behavior is to investigate the so-called 'afterglow phenomena' which is a study of the decay of plasma processes after the removal of the source of excitation. The distribution of energy and its relaxation in a low pressure gas after the passage of a short duration, intense electric discharge is a complex process. (Text Abridged)

SUPPORTED BY U.S. Dept. of Commerce - N.B.S.

8.0005, THEORETICAL STUDIES OF COSMIC-RAY PRODUCTION AND PROPAGATION

A.J. OWENS, Lake Forest College, Undergraduate School, *Lake Forest, Illinois* 60045

SUPPORTED BY Res. Corporation - New York, N.Y.

8.0006, MATHEMATICS OF WAVE PROPAGATION, DIFFRACTION AND SCATTERING

J.B. KELLER, New York University, School of Arts, *New York, New York* 10003 (AF-AFOSR-2013-71)

Research investigations are required in the area of electromagnetic propagation, wave propagation and plasmas, i.e., the development and exploitation of the theory of physical phenomena of energy propagation through homogeneous and nonhomogeneous media. Investigations are required of those parameters that adversely affect systems of communications, surveillance, tracking, navigation and guidance. anomalies, such as ducts, windows and reentry plasma must be investigated for possible use in special-purpose systems of space-to- space and worldwide communication and data transmission, and for general electronic systems. This research program is designed to study the application of asymptotic methods to problems in the propagation, reflection, scattering and diffraction of waves through inhomogeneous and anisotropic media. Typical problems to be examined include the propagation of electromagnetic waves in the ionosphere or in the ionized region surrounding a reentry vehicle, the propagation of acoustic waves and the propagation of elastic waves in layered media. Specific mathematical methods include those associated with the asymptotic solution of high-frequency problems, general perturbation methods, and the existence, uniqueness and stability of solutions of nonlinear partial differential equations, in particular as these apply to the above problem areas.

Supporting agency address information: AF Office of Scientific Research NM, 1400 Wilson Blvd., Arlington, Va. 22209

SUPPORTED BY U.S. Dept. of Defense - Air Force

8.0007, INVESTIGATION OF PION DECAYS AT THE CLINTON P. ANDERSON MESON PHYSICS FACILITY.

W.K. MCFARLANE, Temple University, School of Liberal Arts, *Philadelphia, Pennsylvania* 19122 (AT(11-1)-3539)

1) Pion Beta Decay: The objective is to measure the rate for the decay of the positive pion to a pion and electron and a neutrino. This rate is predicted about 1% by using the CVC hypothesis; present measurements are at the 10% level. It is proposed to improve the measurement accuracy by using decays in flight from a 400 MeV pion beam produced at LAMPF. 2) Three gamma decay of the Neutral Pion: The objective is to make a search for this decay. Forbidden by C- conjugation invariance, this decay presently has a measured upper limit allowing a C-violating amplitude of 0.5 relative to the C-conserving amplitude.

Results: No scientific results. The pion beta decay apparatus is being calibrated.

SUPPORTED BY U.S. Atomic Energy Commission

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, GRAVITATIONAL CONSTANT

G.G. LUTHER, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234

At the present time the universal Newtonian gravitational constant, big G, is perhaps the least well known of the fundamental constants (a few parts in 10 to the third power). An experiment originally devised by Jesse Beams is being designed and built in this laboratory in cooperation with the University of Virginia. It is an experiment of neither the 'Cavendish' nor of the 'Heyl' type. In those experiments gravitational forces are related to the torsional forces in a fiber, but rather it is an experiment in which the gravitional force is related to the inertial force in an acceleration reference frame. The expected precision of this measurement is approximately 1 part in 10 to the third power. Since astronomical data can yield only the product GM (where G is the gravitational constant and M is the mass) a measurement of the gravitational constant is the only way to determine the mass and consequently the average density of the earth, moon and planets. A unique opportunity exists to combine the original ideas and the prototype equipment of Prof. Jesse Beams of the University of Virginia with the technology and metrology available at the NBS in order to redetermine G with previously unattainable accuracy. The experiment is designed so that an accuracy of 10 ppm may be obtained. This is a 100- fold improvement over the current state of the art. The equipment is being built, an improved version of the Beams experiment, consists of a rotating table upon which the force of the gravitational attraction is balanced by the inertial reaction of the masses. The angular acceleration of the table is the quantity to be measured. This method, because of the rotation, averaged the disturbances caused by the asymmetry of the surroundings, and allows the acceleration to be integrated over several hours and several rotations. During the current FY the small mass system has been suspended and data taken on the relaxation properties of the fiber over a period of several months. An autocollimator has been built and tested. A telemetry system has been built and tested. A computer interface has been built and tested. The information gained from the above steps has indicated that preliminary operation by analog servoes will probably not be needed. The major part of the work of building the data taking (time and angle) portion of the experiment has been completed. (Text Abridged)

SUPPORTED BY U.S. Dept. of Commerce - N.B.S.

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Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N75-15601*+ National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 50
Nov. 1974 62 p
(NASA-SP-7037(50)) Avail: NTIS HC $4.00 CSCL 01A

This special bibliography lists 187 reports, articles, and other documents introduced into the NASA Scientific and Technical Information System in October 1974. Author

N75-15602* National Aeronautics and Space Administration, Washington, D.C.
NASA AERONAUTICS
[1974] 12 p Original contains color illustrations
(NF-46/5-74) Avail: SOD HC $0.50 CSCL 01B

A fact sheet depicting the NASA programs involving aircraft development and aeronautics is presented. The fact sheet consists of artist concepts of the various aircraft which represent specific programs. Among the subjects discussed in the concise explanatory notes are: (1) the YF-12 aircraft, (2) hypersonic drag tests in wind tunnels, (3) augmentor wing concepts, (4) rotary wing development, (5) fly-by-wire aircraft control, (6) supercritical wings, (7) the quiet engine program for noise and emission abatement, (8) flight capabilities of lifting bodies, (9) tilt rotor concepts for improved helicopter performance, and (10) flight safety improvements for general aviation aircraft. P.N.F.

N75-15603*+ National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 51
Dec. 1974 69 p refs
(NASA-SP-7037(51)) Avail: NTIS HC $4.00 CSCL 01A

This bibliography lists 206 reports, articles, and other documents introduced into the NASA Scientific and Technical Information System in November 1974. Author

N75-15604# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
BUCKLING OF DISCRETELY STRINGER-STIFFENED CYLINDRICAL SHELLS AND ELASTICALLY RESTRAINED PANELS
Josef Singer and Raphael Haftka May 1974 37 p refs Backup document for AIAA scheduled for publication in the AIAA Journal in July 1975
(Contract AF-AFOSR-61-052-905; Grant AF-AFOSR-2394-72) (TAE-91) Avail: NTIS HC $3.75

The buckling of eccentrically stringer-stiffened cylindrical shells is studied by a 'discrete' approach in which the stringers are considered as linear discontinuities represented by the Dirac delta function. Donnell type linear theory is used. Buckling loads under axial compression are calculated for local and general instability. Results for the latter are compared with those obtained by 'smeared' - stiffener theory. On account of the large number of stringers required to ensure failure by general instability and not by local buckling, the discreteness effect is usually very small. A parametric study is carried out for combinations of shell and stringer parameters chosen to emphasize the discreteness effect. The maximum effect found was 14%. The effect of rotational restraint, due to the torsional stiffness of the stringers, on the buckling of panels is studied. Author

N75-15605*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL MEASUREMENTS OF SKIN FRICTION ON UPPER SURFACE BLOWN WING
Dennis D. Miner and James F. Campbell 3 Jan. 1975 39 p refs
(NASA-TM-X-72634) Avail: NTIS HC $3.75 CSCL 01A

An experimental investigation was conducted to obtain skin-friction measurements on a wing with a circular jet exhausting above it. A Preston tube was used to determine the local shear stress at a point on the wing's upper surface. Data were obtained for four nozzle pressures and four vertical displacements of the jet above the wing. The results indicated that the highest skin-friction values occurred with the jet closest to the wing and with the highest nozzle pressure. These data trends were validated by calculations which combined two-dimensional, turbulent boundary-layer theory with axisymmetric co-flowing jet theory. Author

N75-15606*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL AND THEORETICAL LOW SPEED AERODYNAMIC CHARACTERISTICS OF THE NACA 65 SUB 1-213, ALPHA EQUALS 0.50, AIRFOIL
William D. Beasley and Robert J. McGhee Washington Feb. 1975 74 p refs
(NASA-TM-X-3160; L-9773) Avail: NTIS HC $4.25 CSCL 01A

Low-speed wind-tunnel tests have been conducted to determine the two-dimensional aerodynamic characteristics of the NACA 65 sub 1-213, a = 0.05, airfoil. The results were compared with data from another low-speed wind tunnel and also with theoretical predictions obtained by using a viscous subsonic method. The tests were conducted over a Mach number range from 0.10 to 0.36. Reynolds numbers based on the airfoil chord varied from about 3 million to 23 million. Author

N75-15607*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN ANALYTICAL EVALUATION OF AIRFOIL SECTIONS FOR HELICOPTER ROTOR APPLICATIONS
Gene J. Bingham Washington Feb. 1975 24 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Hampton, Va.
(NASA-TN-D-7796; L-9710) Avail: NTIS HC $3.25 CSCL 01A

An analytical technique was used to evaluate airfoils for helicopter rotor application. This technique permits assessment of the influences of airfoil geometric variations on drag divergence

Mach number at lift coefficients from near zero to near maximum lift. Analytical results presented in this paper indicate the compromises in drag divergence Mach number which result from changes in (1) thickness ratio, (2) location of maximum thickness, (3) leading-edge radius, (4) camber addition, and (5) location of maximum camber of NACA four- and five-digit-series airfoils and some 6-series airfoils of potential interest for helicopters. Examples of airfoil sections which combine several of the geometric changes favorable to both advancing and retreating section performance have been presented. Author

N75-15608*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOW-SPEED WIND-TUNNEL INVESTIGATION OF FORWARD-LOCATED SPOILERS AND TRAILING SPLINES AS TRAILING-VORTEX HAZARD-ALLEVIATION DEVICES ON AN ASPECT-RATIO-8 WING MODEL
Delwin R. Croom Washington Feb. 1975 26 p refs
(NASA-TM-X-3166; L-9892) Avail: NTIS HC $3.75 CSCL 01A

An investigation was made in the Langley V/STOL tunnel in order to determine, by the trailing-wing sensor technique, the effectiveness of either a forward-mounted spoiler or a tip-mounted spline as trailing-vortex attenuation devices on an unswept aspect-ratio-8 wing model. The trailing-wing rolling-moment data taken in the tunnel diffuser section show good agreement with the data taken in the tunnel test section. This agreement indicates that reasonable results may be obtained in the Langley V/STOL tunnel in experimental investigations of the trailing-vortex hazard at relatively great distances behind aircraft models. Author

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N75-15609*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC DAMPING AND OSCILLATORY STABILITY IN PITCH OF A MODEL OF A PROPOSED MANNED LIFTING ENTRY VEHICLE AT MACH NUMBERS OF 1.80, 2.16, AND 2.86
Robert A. Kilgore and Edwin E. Davenport 2 Jan. 1975 27 p refs
(NASA-TM-X-72636) Avail: NTIS HC $3.75 CSCL 01C

Wind tunnel tests were conducted using a model of a proposed manned lifting entry vehicle to determine the aerodynamic damping and oscillatory stability in pitch. The model was tested at Mach numbers of 1.80, 2.16, and 2.86. Angles of attack varied from minus 2 degrees to plus 30 degrees at zero angle of sideslip using a small-amplitude, forced-oscillation technique. It was determined that, in general, all the configurations have near zero or slightly positive damping in pitch throughout the angle of attack range. The effects of the deflection of flaps on aerodynamic damping are discussed. Author

N75-15610*# Texas A&M Univ., College Station. Dept. of Aerospace Engineering.
DEVELOPMENT OF INVERSE INVISCID TRANSONIC SOLUTION METHODS Final Report, Nov. 1973 - Dec. 1974
Leland A. Carlson Dec. 1974 23 p refs
(Grant NGR-44-001-157)
(NASA-CR-142016; TAMRF-3033-7403) Avail: NTIS HC $3.25 CSCL 01A

A numerical method suitable for the analysis and/or design of supercritical transonic airfoils is reported. In order to achieve accuracy, the method utilizes the full inviscid potential flow equations; and in order to remain simple it solves the problem in a stretched Cartesian grid system. The resulting computer program has several advantages over others of its type -- its use in either the direct analysis mode in which the airfoil shape is prescribed and the flow field and surface pressures are determined, or in the inverse mode in which the surface pressures are given and the airfoil shape and flow field are computed. Other advantages of the program include its use in a design program, the rotated finite difference scheme and its determination of the airfoil shape simultaneously with the flow field relaxation solution. Author

N75-15611*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOW SPEED AERODYNAMIC CHARACTERISTICS OF A LIFTING-BODY HYPERSONIC RESEARCH AIRCRAFT CONFIGURATION
Jim A. Penland Washington Feb. 1975 69 p refs
(NASA-TN-D-7851; L-9811) Avail: NTIS HC $4.25 CSCL 01C

An experimental investigation of the low-speed longitudinal, lateral, and directional stability characteristics of a lifting-body hypersonic research airplane concept was conducted in a low-speed tunnel with a 12-foot (3.66-meter) octagonal test section at the Langley Research Center. The model was tested with two sets of horizontal and vertical tip controls having different planform areas, a center vertical tail and two sets of canard controls having trapezoidal and delta planforms, and retracted and deployed engine modules and canopy. This investigation was conducted at a dynamic pressure of 239.4 Pa (5 psf) (Mach number of 0.06) and a Reynolds number of 2 million based on the fuselage length. The tests were conducted through an angle-of-attack range of 0 deg to 30 deg and through horizontal tail deflections of 10 deg to minus 30 deg. The complete configuration exhibited excessive positive static longitudinal stability about the design center-of-gravity location. However, the configuration was unstable laterally at low angles of attack and unstable directionally throughout the angle-of-attack range. Longitudinal control was insufficient to trim at usable angles of attack. Experiments showed that a rearward shift of the center of gravity and the use of a center-located vertical tail would result in a stable and controllable vehicle. Author

N75-15612*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COLD AIR STUDY OF THE EFFECT ON TURBINE STATOR BLADE AERODYNAMIC PERFORMANCE OF COOLANT EJECTION FROM VARIOUS TRAILING EDGE SLOT GEOMETRIES. 2: COMPARISON OF EXPERIMENTAL AND ANALYTICAL RESULTS
Herman W. Prust, Jr. Washington Feb. 1975 27 p refs
(NASA-TM-X-3190; E-8121) Avail: NTIS HC $3.75 CSCL 20D

Experimentally determined efficiencies of turbine stator blades having trailing edge coolant ejection are compared with efficiencies predicted from two previously published approximate analytical methods. The experimental results were obtained from two-dimensional data with the temperature of the primary and coolant flows both being nearly ambient. Data from five stator blade configurations having different slotted trailing-edge geometries were included in the comparison. The two analytical methods gave results which agreed reasonably well with experimental results. An average of the absolute values of differences between experimental and predicted efficiencies for all five blade configurations showed that one method gave average efficiency differences which were about 1.3 percent different than experimental efficiencies, while the other method gave average efficiency differences that were about 0.7 percent different than experimental. However, in some instances, maximum differences of as much as 4 percent occurred. A comparison between experimental and analytical results indicated that the ratio of trailing-edge slot width to trailing-edge thickness influences the measured efficiencies to a greater extent than is accounted for by either analytical model. Author

N75-15613*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
CONDUCT OVERALL TEST OPERATIONS AND EVALUATE TWO DOPPLER SYSTEMS TO DETECT, TRACK AND MEASURE VELOCITIES IN AIRCRAFT WAKE VORTICES Final Report
D. J. Wilson, M. C. Krause, C. E. Craven, B. B. Edwards, E. W. Coffey, C.-C. Huang, J. L. Jetton, and L. K. Morrison Dec. 1974 61 p

(Contract NAS8-30645)
(NASA-CR-120600; LMSC-HREC-TR-D390470) Avail: NTIS HC $3.75 CSCL 01A

A program plan for system evaluation of the two-dimensional Scanning Laser Doppler System (SLDS) is presented. In order to meet system evaluation and optimization objectives the following tests were conducted: (1) noise tests; (2) wind tests; (3) blower flowfield tests; (4) single unit (1-D) flyby tests; and (5) dual unit (2-D) flyby tests. Test results are reported. The final phase of the program included logistics preparation, equipment interface checkouts, and data processing. It is concluded that the SLDS is capable of accurately tracking aircraft wake vortices from small or large aircraft, and in any type of weather. J.M.S.

N75-15614# Sandia Labs., Albuquerque, N.Mex.
BALLOON GONDOLA MEASUREMENTS
P. B. Herrington 1974 6 p Presented at the 8th AFCRL Sci. Balloon Symp., Hyannis, Mass. Sponsored by AEC
(SLA-74-5286; Conf-740914-1) Avail: NTIS HC $3.25

Measurements of gondola attitude were made during a stratospheric balloon flight on September 18, 1972 to provide support data for the scientific instruments on board. Data were obtained from the instruments continuously for one hour during sunrise and eighteen short periods. Measuring methods for spin rate, frame temperature, and levelness and described.
Author (NSA)

N75-15615# New York Univ., N.Y. AEC Computing and Applied Mathematics Center.
THREE DIMENSIONAL FLOWS AROUND AIRFOILS WITH SHOCKS
A. Jameson 1973 29 p refs Presented at IFIP Symp. on Computing Methods in Appl. Sci. and Eng., Paris, Dec. 1973
(Contract AT(11-1)-3077)
(COO-3077-43; Conf-731221-1) Avail: NTIS HC $3.75

The determination of flows containing embedded shock waves over a wing in a stream moving at near sonic speed is considered on an isolated wing placed at an arbitrary yaw angle in a uniform free stream with prescribed Mach number at infinity. According to the Kutta condition the viscous effects cause the circulation at each span station to be such that the flow passes smoothly off the sharp trailing edge. The varying spanwise distribution of lift generates a vortex sheet that trails in the streamwise direction behind the trailing edge, and behind the side edge of the downstream tip. In practice the vortex sheet rolls up behind each tip and decays through viscous effects. A simplified model was used in which convection and decay of the sheet are ignored. At infinity the flow is undisturbed except in the Trefftz plane far downstream, where there will be a two dimensional flow induced by the vortex sheet. NSA

N75-15616# AeroVironment, Inc., Pasadena, Calif.
INFLUENCE OF METEOROLOGICAL FACTORS ON THE VORTEX WAKE OF A LIGHT TWIN-ENGINE AIRCRAFT Final Report, 1 Jun. 1972 - 31 Jan. 1974
Ivar Tombach 25 Mar. 1974 90 p refs
(Contract F44620-72-C-0088)
(AD-787853; AV-FR-416; AFOSR-74-1507TR) Avail: NTIS CSCL 01/1

The smoke-marked trailing vortex wake generated by a light, twin-engine aircraft (AeroCommander 560F) was probed by another instrumented aircraft and the velocity and temperature fields in the wake were measured. Ground-based cameras recorded overall wake motion and decay due to instabilities. It was determined that wakes descending in a stably stratified atmosphere acquire buoyancy and then subsequently begin to lose it before they break up. The speed of descent of the wakes decreases with time, and the vortex spacing and the size of the buoyant oval both increase very slightly as the wake descends. A clear correlation between wake tilting and wind shear has been established, and it was determined that shear is one factor which causes the sometimes-observed single persistent vortex. (Modified author abstract) GRA

N75-15617# Army Materiel Command, Texarkana, Tex. Intern Training Center.
DETERMINATION OF OPTIMAL USE LIFE OF US ARMY T-10 TROOP TYPE PERSONNEL PARACHUTES, PART 2 Final Report
Ronald S. Morris (Texas A and M Univ., Texarkana) and Don E. Ferrell Jun. 1974 31 p
(AD-787299; USAMC-ITC-02-08-73-001-Pt-2) Avail: NTIS CSCL 01/3

This report describes a procedure which, if employed, can provide the data on the properties of personnel parachute assemblies necessary for justification of an age life extension. In Part One of this report, several methods of data collection and analyses are introduced which are currently being employed by the various Services to investigate use and age life limitations of parachutes. Part One dealt primarily with a study, conducted in conjunction with the U.S. Army Natick Laboratories, seeking to justify a use life extension of U.S. Army T-10 troop-type main personnel parachutes. This report details an experimental design which should be used to provide the necessary statistical basis for establishing the degree of an age life extension as recommended in Part One. GRA

N75-15618# Lockheed-Georgia Co., Marietta. Flight Sciences Div.
WAKE EFFECT STUDIES ON A TWO DIMENSIONAL TRAILING EDGE HIGH LIFT SYSTEM Final Report, 22 Jan. 1973 - 22 Apr. 1974
22 Apr. 1974 216 p refs
(Contract N00019-73-C-0239)
(AD-787141) Avail: NTIS CSCL 20/4

Experimental investigations were performed on a two component airfoil for studying the effects of the wake of the forward element on the development of the viscous flow on the upper surface of the flap. Measurements of the initial conditions, the boundary layer on the upper surface of the flap, and pressure distributions on the airfoil surfaces were obtained both in the presence and absence of the wake of the forward element. The nature of the viscous flow on the flap has been examined at angles of attack up to maximum lift coefficient conditions. Correlative analysis was performed to establish the validity and limits of applicability of the present boundary layer methods, confluent boundary layer method, and multi-component airfoil program for the prediction of the aerodynamic performance characteristics. (Modified author abstract) GRA

N75-15619# General Motors Corp., Indianapolis, Ind. Detroit Diesel Allison Div.
RESEARCH ON AEROELASTIC PHENOMENA IN AIRFOIL CASCADES: SUPERSONIC INLET TORSIONAL FLUTTER
Sanford Fleeter, Robert B. McClure, George T. Sinnet, and Robert L. Holtman Sep. 1974 49 p refs
(Contract N00014-72-C-0351; NR Proj. 094-369)
(AD-787088; DDA-EDR-8297) Avail: NTIS CSCL 20/4

The paper describes a unique supersonic inlet with a subsonic axial component, torsional flutter cascade experiment, wherein a computer controlled electromagnetic airfoil excitation system is used to simulate the fundamental time-dependent airfoil interaction; assure periodicity; and control the interblade phasing angle. Experimental data are presented which indicate the variation and significance of the cascade inlet Mach number, the stagger angle, and the interblade phasing angle on the cascade dynamic torsional aeroelastic characteristics. Author (GRA)

N75-15620# Army Aviation Systems Test Activity, Edwards AFB, Calif.
ROTOR FLOW SURVEY PROGRAM UH-1M HELICOPTER Final Report
Barclay H. Boirun, Robert P. Jefferis, and Ronald S. Holasek May 1974 73 p refs
(DA Proj. 1M2-62303-A-214)
(AD-787428; USAASTA-72-05) Avail: NTIS CSCL 01/1

Tests were conducted to determine the rotor wake boundaries and to measure the instantaneous airflow in a test volume adjacent to a UH-1M helicopter under actual flight conditions. The primary test volume of interest was a 4 by 5 by 6-foot box forward of the weapons- mount location. Airflow data were measured by a rake containing 7 split-film total vector anemometers during steady forward airspeeds ranging from hover to 90 knots true airspeed. Flight testing was terminated after one productive

flight because of failure of the anemometer instrumentation. However, the data obtained prior to the sensor failure appeared to be of good quality and are presented for analysis. A second test on an AH-1G helicopter is planned, when a correction for the sensor failures is determined. The UH-1M airflow testing was conducted during April and June 1973. Author (GRA)

N75-15621# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A COMPARISON OF APPROXIMATE METHODS OF PREDICTING SHOCK DETACHMENT DISTANCE FOR TWO-DIMENSIONAL SUPERSONIC INLETS M.S. Thesis
Harry E. Schulte Sep. 1974 59 p refs
(AD-787695; GAE/AE/74S-6) Avail: NTIS CSCL 20/4

The objective of this study is to compare approximate techniques for predicting shock detachment distance in two-dimensional supersonic inlets. The motivation for such a comparison arises from the need to determine more accurately the ramp pressure contribution to supersonic additive drag. Four methods for estimating bow shock position are presented and compared with experimental data from a 20% model of the B-1 external compression supersonic inlet. Static pressure data taken on the third ramp of the B-1 inlet model yield an effective bow shock position with which to compare the prediction procedures. (Modified author abstract) GRA

N75-15622# Naval Air Development Center, Warminster, Pa. Crew Systems Dept.
AERODYNAMIC ANALYSIS OF A PROFILE FIGHTER TOW TARGET
J. B. Smith 22 Oct. 1974 15 p refs
(AD-787639; NADC-74143-30) Avail: NTIS CSCL 01/3

This report presents the aerodynamic characteristics of a proposed aerial tow target configured to meet the requirements of the Navy Standard Tow Target System for a large gunnery target. The Profile Fighter Tow Target will be both size and performance representative of potential enemy fighter airplanes. Author (GRA)

N75-15623# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN EXAMINATION OF THE RATE VARIANCE FORMULA FOR THE A-10 AIR VEHICLE M.S. Thesis
John J. Gaunt, Jr. Sep. 1974 111 p refs
(AD-787705; GSM/SM/74S-8) Avail: NTIS CSCL 01C

The first two lots of production model A-10 close air support aircraft are being purchased under variable lot options. These options allow for the quantity to vary plus or minus 50% from the nominal, or base-line quantities. Baseline prices were established and Rate Variance Formulas (RVF) govern the prices for the other quantities. The Fairchild Republic RVF covers the Air Vehicle. An examination was made of each element within this RVF. The examination included the development and treatment of the costs within each cost element. Comparisons were made with cost estimating relationships developed from previous research, existing theory regarding the manner in which costs vary with changes in quantity and generally accepted principles and practices. Where the available information was inconclusive, sensitivity analysis was performed. (Modified author abstract) GRA

N75-15624# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
TAKEOFF AND LANDING ANALYSIS (TOLA) COMPUTER PROGRAM. PART 2: PROBLEM FORMULATION
Urban H. D. Lynch and John J. Dueweke May 1974 270 p refs
(AF Proj. 1431)
(AD-787656; AFFDL-TR-71-155-Pt-2) Avail: NTIS CSCL 01/2

A well-defined integration of the various aspects of the aircraft takeoff and landing problem is presented in the form of a generalized computer program. Total aircraft system performance is evaluated during the glide slope, flare, landing roll, and takeoff. The flight dynamics of a generalized, rigid body, aerospace vehicle are formulated in six degrees of freedom; a flat, nonrotating earth is assumed. The independent equations of motion of up to five oleo-type landing gears are also formulated. A control management formulation is developed to automatically adjust control variables to correct errors in the vehicle's dynamic state. Stability in the small is used to maintain stability in the large. The equations of motion are integrated using a generalized variable-step Runge-Kutta technique. (Modified author abstract) GRA

N75-15625# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
AEROMECHANICAL ANALYSIS OF A TOW TARGET SYSTEM INSTALLED ON THE A-4 AIRPLANE
D. W. Carroll 4 Sep. 1974 167 p refs
(AD-787059; NADC-74150-30) Avail: NTIS CSCL 01/3

The tow target system installation, analyzed in this report is intended for towing large towed targets for air-to-air and surface-to-air weapon training firing exercises. The system will also provide for the towing of smaller towed targets at towline lengths exceeding 6 miles. The analysis indicates that the installation is adequate, structurally, for target towing missions which are within the capability of the A-4 airplane. Flight test of the system is recommended to determine suitability for service use. Author (GRA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

No abstracts in this category.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *Communications*.

N75-15626*# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
APPLICATION OF MODERN CONTROL THEORY TO SCHEDULING AND PATH-STRETCHING MANEUVERS OF AIRCRAFT IN THE NEAR TERMINAL AREA
Michael Athans Oct. 1974 28 p refs
(Grants NGL-22-009-124; AF-AFOSR-69-1724; AF-AFOSR-72-2273; MIT Proj. OSP-76265)
(NASA-CR-142058; ESL-R-574) Avail: NTIS HC $3.75 CSCL 17G

A design concept of the dynamic control of aircraft in the near terminal area is discussed. An arbitrary set of nominal air routes, with possible multiple merging points, all leading to a single runway, is considered. The system allows for the automated determination of acceleration/deceleration of aircraft along the nominal air routes, as well as for the automated determination of path-stretching delay maneuvers. In addition to normal operating conditions, the system accommodates: (1) variable commanded separations over the outer marker to allow for takeoffs and between successive landings and (2) emergency conditions under which aircraft in distress have priority. The system design is based on a combination of three distinct optimal control problems involving a standard linear-quadratic problem, a parameter optimization problem, and a minimum-time rendezvous problem. Author

N75-15627*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A GENERAL ALGORITHM FOR RELATING GROUND TRAJECTORY DISTANCE, ELAPSED FLIGHT TIME, AND AIRCRAFT AIRSPEED AND ITS APPLICATION TO 4-D GUIDANCE

Edwin C. Foudriat Washington Feb. 1975 23 p refs

(NASA-TN-D-7876; L-9932) Avail: NTIS HC $3.25 CSCL 17B

A general solution using an elliptic integral approximation which relates flight time, aircraft airspeed, and ground distance on straight-line and circular-arc trajectory segments is developed. The solution procedure is applicable to both constant and accelerating aircraft flight. In addition, wind shear including both magnitude and heading change is incorporated in the solution. The solution equations are used in a four-dimensional (4-D) control algorithm where both flight time and final airspeed are specified. The results show that the algorithm converges rapidly and accurately. Author

N75-15628# Semcor, Inc., Moorestown, N.J.

A COMPUTER SIMULATION STUDY OF THE GENERAL PURPOSE MULTIPLEX SYSTEM GPMS APPLIED TO THE INFORMATION TRANSFER REQUIREMENTS OF THE A-7E AIRCRAFT. VOLUME 1: METHODOLOGY AND RESULTS Final Report, 5 Nov. 1973 - 19 Sep. 1974

John J. Kearney 16 Oct. 1974 126 p refs

(Contract N62269-74-C-0185)

(AD-787544; SR-JJK-74-289-1) Avail: NTIS CSCL 17/2

The General Purpose Multiplex System (GPMS) and the avionics data transfer load of the A-7E aircraft were modeled and simulated on a digital computer. System behavior was examined by a series of six runs, which were conducted under normal and casualty conditions for various data loads and GPMS architectures. GPMS is a flexible general purpose multiplex system designed to transfer avionics information aboard Naval aircraft. The report is presented in two volumes. Volume I describes the methodology used to model the GPMS and the A-7E information transfer requirements for the simulation. The analysis of the simulation results and significance of those results are also presented in Volume I. Recommendations for future GPMS design based on the simulation results are given and areas requiring further study are indicated. (Modified author abstract) GRA

N75-15629# Aerospace Guidance and Metrology Center, Newark Air Force Station, Ohio.

PROCEEDINGS OF THE LIFE CYCLE COST TASK GROUP OF THE JOINT SERVICES DATA EXCHANGE FOR INERTIAL SYSTEMS QUARTERLY MEETING Final Report

Thomas Meitzler 13 Jun. 1974 128 p Meeting held at Kennebunkport, Maine, 11-13 Jun. 1974

(AD-787195; AGMC-74-020) Avail: NTIS CSCL 17/7

These proceedings describe the third quarterly meeting of the Life Cycle Cost Task Group of the Joint Services Data Exchange for Inertial Systems. This meeting was held 11-13 June, 1974, in Kennebunkport, Maine. The conference proceedings include an introduction by the Task Group Chairman, Russell M. Genet, educational presentations by several Task Group members, and summaries of three working groups. These three groups derived first-cut algorithms for the improved life cycle cost model in the areas of: (1) Research, Development, Test and Evaluation; (2) Acquisition; (3) Operation and Maintenance. Author (GRA)

N75-15630# Lincoln Lab., Mass. Inst. of Tech., Lexington.

A SIMULATION OF THE DABS SENSOR FOR EVALUATION REPLY PROCESSOR PERFORMANCE Project Report

R. J. McAulay and V. Vitto Sep. 1974 49 p refs

(Contracts F19628-73-C-0002; DOT-FA72WAI-261; FAA Proj. 034-241-261)

(AD-787633; ATC-28; FAA-RD-74-123) Avail: NTIS CSCL 17/7

In order to evaluate the effects of ATCRBS interference on the design of a Discrete Address Beacon System (DABS) sensor, a simulation program was developed. A detailed model of the sensor is presented that takes into account many of the antenna pattern and signal processing design parameters. A model for the fruit generator is developed so that reply processor performance in typical 1980 high density fruit environments can be evaluated. A particular reply processing algorithm is adopted as a baseline to decode DABS messages and produce a data edited azimuth estimate, so that the design methodology can be illustrated. Statistics characterizing the reliability of the processor are computed as a function of fruit rate and signalling conditions. The simulation is an invaluable tool for performing sensor/reply processor tradeoff studies. Author (GRA)

N75-15631# Aerospace Guidance and Metrology Center, Newark Air Force Station, Ohio.

PROCEEDINGS OF THE LIFE CYCLE COST TASK GROUP OF THE JOINT SERVICES DATA EXCHANGE FOR INERTIAL SYSTEMS QUARTERLY MEETING Final Report

19 Aug. 1974 41 p Meeting held at Cambridge, Mass., 19 Aug. 1974

(AD-787220; AGMC-74-028) Avail: NTIS CSCL 17/7

These proceedings describe the 4th quarterly meeting of the Life Cycle Cost Task Group of the Joint Services Data Exchange for Inertial Systems. This meeting was held 19 Aug. 74, in Cambridge, MA. The conference proceedings include a foreward by the Task Group Chairman, Russell B. Stauffer, educational presentations by Task Group members, and the proceedings of the newly formed Executive Board including plans for the 1974-1975 year. Author (GRA)

N75-15632# Boeing Commercial Airplane Co., Seattle, Wash.

STRATEGIC CONTROL ALGORITHM DEVELOPMENT. VOLUME 1: SUMMARY Final Report, Nov. 1972 - Dec. 1973

R. L. Erwin, M. J. Omoth, W. H. Galer, D. Hartnell, and A. L. Yarrington Aug. 1974 71 p refs

(Contract DOT-TSC-538)

(PB-236719/1; DOT-TSC-OST-74-3-1) Avail: NTIS HC $4.25 HC also available from NTIS $34.00/set of 6 reports as PB-236718-SET CSCL 17G

Strategic control is an air traffic management concept wherein a central control authority determines, and assigns to each participating airplane, a conflict-free, four-dimensional route-time profile. This concept results in terminal area capacity increases, delay reductions, safety improvement, and controller workload reductions. Maximum benefits are expected to occur at the busy terminal areas where demand is high and airspace is at a premium. The results of a study to develop the basic algorithm for strategic control of arrivals are summarized. The strategic control concept is described as to operational concept, ATC system, airplane system, and application to U.S. airspace. (Modified author abstract) GRA

N75-15633# Boeing Commercial Airplane Co., Seattle, Wash.

STRATEGIC CONTROL ALGORITHM DEVELOPMENT. VOLUME 2A: TECHNICAL REPORT Final Report, Nov. 1972 - Dec. 1973

R. L. Erwin, M. J. Omoth, W. H. Galer, D. Hartnell, and A. L. Yarrington Aug. 1974 236 p

(Contract DOT-TSC-538)

(PB-236720/9; DOT-TSC-OST-74-3-2A) Avail: NTIS HC $7.50 HC also available from NITS $34.00/set of 6 reports as PB-236718-SET CSCL 17G

The technical report presents a detailed description of the strategic control functional objectives, followed by a presentation of the basic strategic control algorithm and how it evolved. Contained in this discussion are results of analyses that constrain the design and operation of the strategic control algorithm and a description of the model developed to simulate strategic terminal area operation in order to develop and evaluate the algorithm. The data processing sizing requirements and the application of the strategic control algorithm in terms of time periods and airspace to be served are presented with an overall summary of the benefits of the system. Finally, a proposed research, development, test, and evaluation plan is detailed for developing the strategic control system capabilities for implementation as the primary air traffic management technique for high-density air routes and terminal areas. GRA

N75-15634# Boeing Commercial Airplane Co., Seattle, Wash.

STRATEGIC CONTROL ALGORITHM DEVELOPMENT. VOLUME 2B: TECHNICAL REPORT (CONCLUDED) Final

Report, Nov. 1972 - Dec. 1973
R. L. Erwin, M. J. Omoth, W. H. Galer, D. Hartnell, and A. L. Yarrington Aug. 1974 180 p refs
(Contract DOT-TSC-538)
(PB-236721/7; DOT-TSC-OST-74-3-2B) Avail: NTIS HC $7.00 HC also available from NTIS $34.00/set of 6 reports as PB-236718-SET CSCL 17G
For abstract, see N75-15633.

N75-15635# Boeing Commercial Airplane Co., Seattle, Wash.
STRATEGIC CONTROL ALGORITHM DEVELOPMENT. VOLUME 3: STRATEGIC ALGORITHM REPORT Final Report, Nov. 1972 - Dec. 1973
R. L. Erwin, M. J. Omoth, W. H. Galer, D. Hartnell, and A. L. Yarrington Aug. 1974 91 p refs
(Contract DOT-TSC-538)
(PB-236722/5; DOT-TSC-OST-74-3-3) Avail: NTIS HC $4.75 HC also available from NTIS $34.00/set of 6 reports as PB-236718-SET CSCL 17G
The strategic algorithm report presents a detailed description of the functional basic strategic control arrival algorithm. This description is independent of a particular computer or language. Contained in this discussion are the geometrical and environmental considerations and the required arrival traffic data requirements. The methods of providing sequencing and control point scheduling are discussed as is the means of developing a conflict-free, four-dimensional route-time profile that achieves the scheduling objectives. GRA

N75-15636# Boeing Commercial Airplane Co., Seattle, Wash.
STRATEGIC CONTROL ALGORITHM DEVELOPMENT. VOLUME 4A: COMPUTER PROGRAM REPORT Final Report, Nov. 1972 - Dec. 1973
R. L. Erwin, M. J. Omoth, W. H. Galer, D. Hartnell, and A. L. Yarrington Aug. 1974 272 p
(Contract DOT-TSC-538)
(PB-236723/3; DOT-TSC-OST-74-3-4A) Avail: NTIS HC $8.50 HC also available from NTIS $34.00/set of 6 reports as PB-236718-SET CSCL 17G
A description of the strategic algorithm evaluation model is presented, both at the user and programmer levels. The model representation of an airport configuration, environmental considerations, the strategic control algorithm logic, and the airplane simulation model are delineated, together with data inputs and outputs. Detailed instructions for running the model include the input deck setup. Listings of the complete program, as well as detailed logic flow charts and a variable dictionary, are included. Program storage requirements and machine dependence consideration are also discussed. GRA

N75-15637# Boeing Commercial Airplane Co., Seattle, Wash.
STRATEGIC CONTROL ALGORITHM DEVELOPMENT. VOLUME 4B: COMPUTER PROGRAM REPORT (CONCLUDED) Final Report, Nov. 1972 - Dec. 1973
R. L. Erwin, M. J. Omoth, W. H. Galer, D. Hartnell, and A. L. Yarrington Aug. 1974 272 p
(Contract DOT-TSC-538)
(PB-236724/1; DOT-TSC-OST-74-3-4B) Avail: NTIS HC $8.50 CSCL 17G
For abstract, see N75-15636.

N75-15638# TRW Systems Group, McLean, Va.
AUTOMATION APPLICATIONS IN AN ADVANCED AIR TRAFFIC MANAGEMENT SYSTEM. VOLUME 1: SUMMARY Final Report, Nov. 1972 - Jan. 1974
F. Mertes and L. Jenney Aug. 1974 196 p refs
(Contract DOT-TSC-512)
(PB-236801/7; DOT-TSC-OTS-74-14-1-Vol-1) Avail: NTIS HC $7.00 CSCL 17G
The Advanced Air Traffic Management System (AATMS) program is a long range investigation of new concepts and techniques for controlling air traffic and providing services to the growing number of commercial, military, and general aviation users of the national airspace. The purposes were to specify and describe the desirable extent of automation of AATMS, to estimate the requirements for man and machine resources associated with such a degree of automation, and to examine the prospective employment of humans and automata as air traffic management is converted from a labor-intensive to a machine-intensive activity. GRA

N75-16294 Eurocontrol Agency, Maastricht (Netherlands).
THE MAASTRICHT DATA PROCESSING AND DISPLAY SYSTEM: A STEP IN AUTOMATION OF AIR TRAFFIC CONTROL (THE SOFTWARE STRUCTURE OF THE SYSTEM)
R. Ehrmanntraut *In* AGARD Real Time Computer Based Systems Dec. 1974 14 p (For availability see N75-16257 07-62)

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.
For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N75-15639*# Clemson Univ., S.C. Mechanical Engineering Dept.
OPTIMIZATION OF STRUCTURES TO SATISFY AEROELASTIC REQUIREMENTS Final Technical Report
Carl S. Rudisill Feb. 1975 29 p refs
(Grant NGR-41-001-027)
(NASA-CR-142021) Avail: NTIS HC $3.75 CSCL 20K
A method for the optimization of structures to satisfy flutter velocity constraints is presented along with a method for determining the flutter velocity. A method for the optimization of structures to satisfy divergence velocity constraints is included. Author

N75-15640*# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.
FLIGHT INVESTIGATION OF ROTOR/VEHICLE STATE FEEDBACK
Stanley J. Briczinski and Dean E. Cooper [1975] 173 p refs Sponsored in part by Army Air Mobility R and D Lab., Hampton, Va.
(Contract NAS1-11563)
(NASA-CR-132546; SER-50905) Avail: NTIS HC $6.25 CSCL 01C
The feasibility of using control feedback or rotor tip-path-plane motion or body state as a means of altering rotor and fuselage response in a prescribed manner was investigated to determine the practical limitations of in-flight utilization of a digital computer which conditions and shapes rotor flapping and fuselage state information as feedback signals, before routing these signals to the differential servo actuators. The analysis and test of various feedback schemes are discussed. Test results show that a Kalman estimator routine which is based on only the first harmonic contributions of blade flapping yields tip-path-plane coefficients which are adequate for use in feedback systems, at speeds up to 150 kts. F.O.S.

N75-15641# Advisory Group for Aerospace Research and Development, Paris (France).
EFFECTS OF SURFACE WINDS AND GUSTS ON AIRCRAFT DESIGN AND OPERATION
Nov. 1974 95 p refs
(AGARD-R-626) Avail: NTIS HC $4.75
An analysis of the effects of surface winds and gusts on aircraft stability and control is presented. The analysis is applied to the development of airframes, improvement of basic airworthiness, better flight characteristics through gust load alleviation, and methods for avoiding atmospheric turbulence. The subjects discussed are as follows: (1) the wind characteristics in the planetary boundary layer, (2) research on aeronautical effects of surface winds and gusts, and (3) the use of radiosonde data to derive atmospheric wind shears for small shear increments. Graphs and tables of wind characteristics, wind speed dispersion, and statistical analyses of gust load conditions. For individual titles, see N75-15642 through N75-15644.

N75-15642 Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.

WIND CHARACTERISTICS IN THE PLANETARY BOUNDARY LAYER c47
Henry Rachele and Manuel Armendariz *In* AGARD Effects of Surface Winds and Gusts on Aircraft Design and Operation Nov. 1974 p 1-58 refs (For availability see N75-15641 07-05)

Equations, graphs, correlation coefficients, and tabulated results describing wind shear, gust factors, wind variability, and the turbulent characteristics of the atmosphere are presented. Data were collected in the planetary boundary layer at White Sands Missile Range (WMSR), New Mexico. When possible, results were compared with those obtained by other investigators in other parts of the country. In most cases, it was found that simple mathematical models could be used to describe the meteorological parameter as a function of stability. Author

N75-15643 Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
UK RESEARCH ON AERONAUTICAL EFFECTS OF SURFACE WINDS AND GUSTS c47
J. G. Jones *In* AGARD Effects of Surface Winds and Gusts on Aircraft Design and Operation Nov. 1974 p 59-78 refs (For availability see N75-15641 07-05)

An outline of topics concerning aeronautical effects of surface winds and gusts currently under investigation in the UK or planned for future research is presented. Emphasis is upon effects on aircraft handling and ride qualities, although attention is drawn to the influence of handling performance upon loads experienced in turbulence. Particular areas discussed include turbulence models and related procedures for aircraft airworthiness requirements, turbulence models for ground-based simulation, criteria for aircraft ride quality, the representation of the human pilot in analytical studies of flight in turbulence, and the use of active controls for gust alleviation. Author

N75-15644 Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala.
USE OF RADIOSONDE DATA TO DERIVE ATMOSPHERIC WIND SHEARS FOR SMALL SHEAR INCREMENTS c47
Oskar M. Essenwanger *In* AGARD Effects of Surface Winds and Gusts on Aircraft Design and Operation Nov. 1974 p 79-88 refs (For availability see N75-15641 07-05)

The wind vector shear in the lowest 5000 feet for the 90, 95 and 99 percent threshold of the annual cumulative distribution and the maximum shear from 14 stations of the climatological ringbook and 27 stations of unpublished vector shear distributions are derived. All data were normalized to a 100 m shear interval by a formula. The outcome of the analysis confirms that the vector shear decreases from the surface to a minimum at around 2 km. A definite latitudinal dependence can be discovered with the mid-latitudes exposing the strongest shear while the polar or tropical zones display significantly lower values. Tables for 100 m and 50 m shear intervals are given for the average 90, 95 and 99 percent threshold and the maximum shear within three typical geographic zones (polar, mid-latitude and tropical), and for the station with the strongest shears within that zone. Author

N75-15645# ARO, Inc., Arnold Air Force Station, Tenn.
EFFECT OF VARIOUS EXTERNAL STORES ON THE AERODYNAMIC CHARACTERISTICS OF THE F-4C AIRCRAFT Final Report, 10 Sep. - 13 Oct. 1973
J. M. Whoric AEDC Oct. 1974 169 p refs
(AF Proj. 2567; ARO Proj. PA305)
(AD-787657; ARO-PWT-TR-74-50; AFATL-TR-74-113; AEDC-TR-74-75) Avail: NTIS CSCL 01/3

The results obtained from wind tunnel tests, which were conducted to determine the effects of external carriage of several configurations of winged stores on the aerodynamic characteristics of the F-4C aircraft, are presented and discussed. The analysis includes evaluation of the static longitudinal stability, drag, and longitudinal control characteristics of the F-4C aircraft with winged stores. Incremental drag rise and neutral-point shift associated with some of the store loadings are compared with results obtained from existing prediction techniques and methods. (Modified author abstract) GRA

N75-15646# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
THE PROPER SELECTION OF ENGINE CYCLES Final Report, Apr. 1970 - Jun. 1973
Robert J. May, Jr. and J. Alan Rowlands Apr. 1974 65 p refs
(AF Proj. 3066)
(AD-787654; AFAPL-TR-73-118) Avail: NTIS CSCL 01/1

The work proposes the nucleus of an engine airframe integration methodology evolved at the Air Force Aero Propulsion Laboratory, drawing on a considerable number of past integration efforts, both successful and unsuccessful. Only the nucleus is presented so as to encourage each contractor to apply his unique expertise and improve individual segments of the methodology. This common method of approaching the problem of engine-airframe integration should stimulate communication within the field of integration. The methodology also provides the ability to meet reasonable changes in system requirements and the problems encountered in component performance in an orderly fashion rather than in a crisis management atmosphere. GRA

N75-15647# Air Force Flight Test Center, Edwards AFB, Calif.
A COMPARISON AND EVALUATION OF TWO METHODS OF EXTRACTING STABILITY DERIVATIVES FROM FLIGHT TEST DATA Final Report
Paul W. Kirster and Lawrence G. Ash May 1974 86 p refs
(AD-787645; AFFTC-TD-73-5) Avail: NTIS CSCL 01/2

Two methods for extracting stability derivatives from flight data are compared. A modified Newton-Raphson minimization technique and a digital-analog (hybrid) matching technique were used to analyze the same data maneuvers obtained from two aircraft. About 55 maneuvers of an F-111E aircraft were analyzed over a Mach number range of 0.3 to 2.0 and an angle of attack range of 3 to 19 degrees. About 15 maneuvers were analyzed for the X-24A lifting body at Mach numbers of 0.8 and 0.9 and an angle of attack range of 4 to 13 degrees. Stability derivatives were extracted from these maneuvers, and the results from the two techniques along with wind tunnel results were compared. (Modified author abstract) GRA

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N75-15648*# Santa Clara Univ., Calif. Dept. of Electrical Engineering and Computer Science.
VECTOR MAGNETOMETER AS AN ATTITUDE DETERMINING INSTRUMENT
R. Pietila and W. R. Dunn, Jr. 27 Dec. 1974 18 p refs
(Grant NGR-05-017-031)
(NASA-CR-142024) Avail: NTIS HC $3.25 CSCL 01D

The solid state vector magnetometer sensor system is presented for the accuracy and reliability of existing systems, and for providing independent measures of attitude. Since a large number of aircraft heading reference systems depend on measurement of the earth's magnetic field, it can be shown that by substituting a 3-axis magnetometer for the remote sensing unit, both heading and attitude measurement functions can be derived using common elements. Sample calculations are made using the earth's magnetic field data acquired during actual flight conditions. M.C.F.

N75-15649# Royal Aircraft Establishment, Farnborough (England).
MODERN FLIGHT PATH RECORDING EQUIPMENT
A. Tert Oct. 1974 26 p Transl. into ENGLISH from the AGARD Flight Mech. Meeting, Edinburgh, 1974 (French language document)
(RAE-Lib-Trans-1799; BR44351) Avail: NTIS HC $3.75

Methods for recording take-off and landing flight paths were investigated. Laser radar proved to be a suitable means for the precise flight path recording required in tests on all-weather landing equipment. Airborne equipment using inertial platforms met the requirements of performance flight path recording, while

rendering the aircraft independent of its test base, provided that a correction procedure is used. Author

N75-15650# Hughes Research Labs., Malibu, Calif.
HOLOGRAPHIC LENS FOR PILOT'S HEAD-UP DISPLAY Final Report, 2 Apr. 1973 - 1 Apr. 1974
D. H. Close and A. Graube 1 Aug. 1974 120 p refs
(Contract N62269-73-C-0388)
(AD-787605) Avail: NTIS CSCL 09/5

The report describes work on the development of a hologram lens system for a Head-Up Display (HUD) System having a 25 degrees field of view, a 25-in. eye relief, and a 3-in. high by 5-in. wide exit pupil. The work includes a parametric analysis study, preliminary system design, development of a red-sensitive hologram recording material, and experimental work on a hologram lens element. The parametric analysis study is based on the Hughes continuous hologram lens design approach, applied to displays. Ray tracing, with efficiency calculations, is used to determine and compare focal surfaces, image distortions, aberrations and pupil errors, for several reflection and transmission hologram lenses. (Modified author abstract) GRA

N75-16241 Ferranti, Ltd., Bracknell (England).
AVIONICS SYSTEM ARCHITECTURE
R. E. Wright *In* AGARD Principles of Avionics Computer Systems Dec. 1974 p 64-87 refs (For availability see N75-16236 07-59)

N75-16284 Marconi-Elliott Avionic Systems Ltd., Rochester (England). Airport Works.
THE INFLUENCE OF AVIONIC SYSTEM REQUIREMENT ON AIRBORNE COMPUTER DESIGN
J. T. Shepherd *In* AGARD Real Time Computer Based Systems Dec. 1974 21 p (For availability see N75-16257 07-62)

N75-16286 Computing Devices of Canada, Ltd., Ottawa (Ontario).
MICROPROGRAMMED COMPUTER COMBINED AVIONICS DISPLAY AND DATA PROCESSING
Dale R. Younge *In* AGARD Real Time Computer Based Systems Dec. 1974 12 p (For availability see N75-16257 07-62)

N75-16291 Ministry of Defence, London (England).
DEVELOPMENT EXPERIENCES OF REAL TIME COMPUTER BASED SYSTEMS IN STRIKE AIRCRAFT
C. J. U. Roberts *In* AGARD Real Time Computer Based Systems Dec. 1974 6 p (For availability see N75-16257 07-62)

N75-16292 International Business Machines Corp., Owego, N.Y.
LAMPS: A CASE HISTORY OF PROBLEMS/DESIGN OBJECTIVES FOR AN AIRBORNE DATA HANDLING SUBSYSTEM
Rex Reed and Howard J. Cattie, Jr. (NADC, Warminster, Pa.) *In* AGARD Real Time Computer Based Systems Dec. 1974 11 p (For availability see N75-16257 07-62)

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N75-15651*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NORMAL INJECTION OF HELIUM FROM SWEPT STRUTS INTO DUCTED SUPERSONIC FLOW
Charles R. McClinton and Marvin G. Torrence Jan. 1975 58 p refs
(NASA-TM-X-72632) Avail: NTIS HC $4.25 CSCL 01B

Recent design studies have shown that airframe-integrated scramjets should include instream mounted, swept-back strut fuel injectors to obtain short combustors. Because there was no data in the literature on mixing characteristics of swept strut fuel injectors, the present investigation was undertaken to provide such data. This investigation was made with two swept struts in a closed duct at Mach number of 4.4 and nominal jet-to-air mass flow ratio of 0.029 with helium used to simulate hydrogen fuel. The data is compared with flat plate mounted normal injector data to obtain the effect of swept struts on mixing. Three injector patterns were evaluated representing the range of hole spacing and jet-to-freestream dynamic pressure ratio of interest. Measured helium concentration, pitot pressure, and static pressure in the downstream mixing region are used to generate contour plots necessary to define the mixing region flow field and the mixing parameters. Author

N75-15652*# Pratt and Whitney Aircraft, East Hartford, Conn.
TWO-STAGE FAN. 4: PERFORMANCE DATA FOR STATOR SETTING ANGLE OPTIMIZATION
G. D. Burger and M. J. Keenan Jan. 1975 301 p refs
(Contract NAS3-13494)
(NASA-CR-134717; PWA-5225) Avail: NTIS HC $9.25 CSCL 21E

Stator setting angle optimization tests were conducted on a two-stage fan to improve efficiency at overspeed, stall margin at design speed, and both efficiency and stall margin at partspeed. The fan has a design pressure ratio of 2.8, a flow rate of 184.2 lb/sec (83.55 kg/sec) and a 1st-stage rotor tip speed of 1450 ft/sec (441.96 in/sec). Performance was obtained at 70,100, and 105 percent of design speed with different combinations of 1st-stage and 2nd-stage stator settings. One combination of settings, other than design, was common to all three speeds. At design speed, a 2.0 percentage point increase in stall margin was obtained at the expense of a 1.3 percentage point efficiency decrease. At 105 percent speed, efficiency was improved by 1.8 percentage points but stall margin decreased 4.7 percentage points. At 70 percent speed, no change in stall margin or operating line efficiency was obtained with stator resets although considerable speed-flow requlation occurred. Author

N75-15653*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FORWARD VELOCITY EFFECTS ON UNDER-THE-WING EXTERNALLY BLOWN FLAP NOISE
J. Goodykoontz, U. VonGlahn, and R. Dorsch 1975 21 p refs Proposed for presentation at 2d Aero-Acoustics Specialists Conf., Hampton, Va., 24-26 Mar. 1975; sponsored by AIAA
(NASA-TM-X-71656; E-8235) Avail: NTIS HC $3.25 CSCL 20A

Noise tests were conducted with small-scale models of externally blown-flap powered-lift systems that were subjected to simulated takeoff and landing free-stream velocities by placing the nozzle-wing models in a free jet. The nozzle configurations consisted of a conical and an 8-tube mixer nozzle. The results show that the free-stream velocity attenuates the noise from the various configurations, with the amount of attenuation depending on the flap setting. More attenuation was obtained with a flap setting of 20 degrees than with a flap setting of 60 degrees. The dynamic effect on the total attenuation caused by aircraft motion is also discussed. Author

N75-15654# Dayton Univ. Research Inst., Ohio.
ENCAPSULATED TUNED DAMPERS FOR JET ENGINE COMPONENT VIBRATION CONTROL (LOG NO. C2364)
Michael L. Parin and David I. G. Jones (AFML) 16 Jan. 1975 30 p refs Backup document for AIAA Synoptic scheduled for publication in Journal of Aircraft in May 1975
(AF Proj. 735106)
Avail: NTIS HC $3.75 CSCL 21E

An investigation of the dynamic behavior of an encapsulated-beam tuned damping device was conducted. The tests involved isolation and reduction of the vibration levels in a jet engine turbine blade at high temperatures. The investigation showed that such a damper is feasible. Some of the engineering difficulties which must be overcome for successful operation at high temperatures and centrifugal loadings are discussed. Author

N75-15655*# Aerophysics Research Corp., Hampton, Va.
PREDICTION OF SONIC BOOM FROM EXPERIMENTAL NEAR-FIELD OVERPRESSURE DATA. VOLUME 2: DATA

BASE CONSTRUCTION Final Report
C. R. Glatt, S. J. Reiners, and D. S. Hague Washington NASA Feb. 1975 81 p ref
(Contract NAS1-12579)
(NASA-CR-2442) Avail: NTIS HC $4.75 CSCL 20A

A computerized method for storing, updating and augmenting experimentally determined overpressure signatures has been developed. A data base of pressure signatures for a shuttle type vehicle has been stored. The data base has been used for the prediction of sonic boom with the program described in Volume I. Author

N75-15656# Technische Universitaet, Munich (West Germany).
VIBRATORY WAVES OF TURBOMACHINERY: A CONTRIBUTION TO IMPROVED MEASUREMENT RESULTS Ph.D. Thesis [WELLENSCHWINGUNGEN AN TURBOMASCHINEN: EIN BEITRAG ZUR VERBESSERUNG DER AUSSAGEKRAFT BEI MESSUNGEN]
Helmut Geis 16 Jul. 1974 142 p refs In GERMAN
Avail: NTIS HC $5.75

Linearized differential equations are used to formulate a method for calculating vibrational amplitude variations inside the casing or bearing of large turbine rotors from measurements in the gap between bearing block and casing. Transl. by G.G.

N75-15657# Technische Universitaet, Munich (West Germany).
TOXIC EXHAUST STUDY ON OTTO ENGINE WITH SPECIAL EMPHASIS ON INTERNAL CONDITIONS OF ENGINE OPERATION Ph.D. Thesis [BEITRAG ZER UNTERSUCHUNG DER SCHADSTOFFEMISSIONEN EINES OTTOMOTORS UNTER BESONDERER BERUECKSICHTIGUNG DES INSTATIONAEREN MOTORBETRIEBES]
Klaus Zeilinger 31 Jul. 1974 219 p refs In GERMAN
Avail: NTIS HC

Air distribution and ignition point time mostly determine the extent of toxic emissions from automobile engines. A performance gjaph optimization method is used to find the acceptable loss in air distribution and ignition time point ratio for minimal production of nitrous oxide and hydrocarbon emissions.
Transl. by G.G.

N75-15658# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
ENGINE DEVELOPMENT PROGRAM FOR THE APL REMOTELY PILOTED VEHICLE
T. R. Small Jul. 1974 35 p
(Contract N00017-72-C-4401)
(AD-787507; APL-TG-1249) Avail: NTIS CSCL 01/3

Performance of a custom-built (Sakert-Riggs) two-cylinder glow plug engine for use in the APL Remotely Piloted Vehicle was tested. Output power was less than expected, and plans to modify the engine to increase its power were foiled because of the early discovery of a structural weakness that showed up in every unit tested. An alternate engine was then developed, based on a low-cost proven design (McCulloch) that had been in quantity production for a number of years. This engine showed higher peak power and weighs more, but requires less than one-fourth the fuel at cruise power, primarily because it uses spark plug ignition with gasoline rather than glow plug ignition with methanol. Late in the test program, another brand (Kolbo) custom-built two-cylinder glow plug engine was introduced. Limited testing showed it to be a satisfactory, lightweight, but fuel-hungry engine. Author (GRA)

N75-15659# Illinois Univ., Chicago.
GRAPHICS PACKAGE FOR FAILURE SURFACES AND BLADES Final Report, Jun. - Dec. 1973
T. B. Belytschko, J. Burke, and A. B. Schultz Jan. 1974 46 p refs
(Contract F33615-73-C-5148)
(AD-787744; AFML-TR-73-313) Avail: NTIS CSCL 21/5

This graphics package was developed for the purpose of illustrating three dimensional mechanics problem of importance to the researcher in composite structures and fan blade mechanics. The package has been specifically developed to illustrate failure surfaces in stress or strain space, and deformed fan blades under bird impact with both bending and twisting of cross-sections. These geometrical figures can be viewed from any point and hidden portions of the figures are deleted. Some sample results for both problems are given. Author (GRA)

N75-15660# ARO, Inc., Arnold Air Force Station, Tenn.
EXPERIMENTAL VERIFICATION OF A TRANSONIC TEST TECHNIQUE FOR FULL-SCALE INLET/ENGINE SYSTEMS SIMULATING MANEUVERING ATTITUDES Final Report, 1 Jul. 1973 - 30 Jun. 1974
R. L. Palko AEDC Oct. 1974 36 p refs
(ARO Proj. PF418; ARO Proj. PA428)
(AD-787659; ARO-PWT-TR-74-51; AEDC-TR-74-80) Avail: NTIS CSCL 21/5

An experimental investigation was conducted to demonstrate the capability of a newly developed flow-shaping technique to test full-scale inlet/engine systems in the AEDC 16-ft Propulsion Wind Tunnel (transonic) at angles of yaw and combinations of angle of attack and yaw. Simulation of the flow field approaching the inlet was accomplished at Mach numbers in the range from 0.6 to 0.9 at positive yaw angles up to 6 deg over an angle-of-attack range from 0 to 8 deg and at negative yaw angles up to 6 deg over an angle of attack range from 0 to 12 deg. Inlet pressure distribution (ramp, lip, and sideplate), local flow angularity, and local Mach number in front of the inlet were used to verify the technique. (Modified author abstract) GRA

N75-15661# Naval Postgraduate School, Monterey, Calif.
THE PULSEJET ENGINE: A REVIEW OF ITS DEVELOPMENT POTENTIAL M.S. Thesis
John Grant OBrien Jun. 1974 120 p refs
(AD-787439) Avail: NTIS CSCL 21/5

The pulsejet was the object of much concentrated study immediately after World War II, but in spite of this intense study, the pulsejet has never lived up to its promised performance. Recently, there has been a renewal of interest in the pulsejet and a considerable amount of research and experimentation has been conducted. Some recent developments are: pulsejets which are capable of supersonic operation, use of pulsejets for auxiliary power generation, and attempts to use a pulsejet as a combustor for a gas turbine engine. This paper reviews this recent work and includes thermodynamic analysis, a description of wave processes, and a description of the ignition mechanism. The problems of noise and vibration are also addressed. From this study of recent work, several potential applications are proposed, and recommendations about areas requiring further study are made. Author (GRA)

N75-16243 Smiths Industries Ltd., London (England). Aviation Div.
MONITORING AND CONTROL OF AEROSPACE VEHICLE PROPULSION
E. S. Eccles *In* AGARD Principles of Avionics Computer Systems Dec. 1974 p 119-142 refs (For availability see N75-16236 07-59)
Avail: NTIS

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

No abstracts in this category.

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N75-15662* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
KINESTHETIC CONTROL SIMULATOR Patent
Paul R. Hill and David F. Thomas, Jr., inventors (to NASA) Issued 14 Jan. 1975 7 p Filed 20 Apr. 1970 Supersedes N70-26813 (08 - 13, p 2363)
(NASA-Case-LAR-10276-1; US-Patent-3,859,736; US-Patent-Appl-SN-29979; US-Patent-Class-35-12C; US-Patent-Class-272-1R; US-Patent-Class-272-57A) Avail: US Patent Office CSCL 14B

A kinesthetic control simulator is reported that has a flat base upon which rests a support structure having a lower spherical surface for rotation on the base plate with columns which support a platform above the support structure at a desired location with respect to the center of curvature of the spherical surface. A handrail is at approximately the elevation of the hips of the operator above the platform with a ring attached to the support structure which may be used to limit the angle of tilt. Five degree freedom-of-motion can be obtained by utilizing an air pad structure for support of the control simulator.
Official Gazette of the U.S. Patent Office

N75-15663# Arnold Engineering Development Center, Arnold Air Force Station, Tenn. Requirements Planning Div.
GROUND SIMULATION OF MANEUVER FORCES ON TURBINE ENGINES
Gerald M. Mulenburg 1 Aug. 1974 32 p Backup document for AIAA Synoptic scheduled for publication in Journal of Aircraft in May 1975
Avail: NTIS HC $3.75

The results of a study that identifies the need for, and feasibility of, ground simulation of flight maneuver forces on turbine engines are reported. The main emphasis of the study is on the application of realistic combinations of gyroscopic forces and g loads to an operating turbine engine. After confirming that a requirement exists for this type of testing, identification of basic test parameters leads to the development of several test facility concepts. Analysis of the facility concepts for their ability to duplicate the desired load spectrum and for construction feasibility reduces the number to a few promising designs. Detailed trade-off studies and cost analyses of these selected designs and their subsystems, including advanced instrumentation techniques, allow further evaluation of their potential as test facilities. The findings of the study include substantiating data and assumptions. Author

N75-15664# Sandia Labs., Albuquerque, N.Mex.
DAVIS GUN PENETRATOR LAUNCH SYSTEM
L. O. Seamons 15 Aug. 1974 14 p refs
(SAND-74-5048) Avail: NTIS HC $3.25

Interest in experimenting with large high velocity vehicle penetration of in-situ undisturbed earth targets has culminated with a new test facility, the Davis gun penetrator launch system. The launch system is a trailer mounted gun. The trailer provides mobility and doubles as a gun mount and gun elevation mechanism. The Davis gun is a special type of recoilless gun and fires test vehicles downwards into earth targets only a few feet away. The advantages of the Davis gun over other candidate guns resulted in its selection for the facility. Author (NSA)

N75-15665# Sandia Labs., Albuquerque, N.Mex.
TONOPAH TEST RANGE
K. J. Datz Aug. 1974 42 p
(Contract AT(29-1)-789)
(SLA-74-0231) Avail: NTIS HC $3.75

The brochure was prepared to inform potential users about TTR's test capabilities and current range facilities, the major items of which include hard and soft targets (dry lakes), rocket launchers and cannons, electronic and optical tracking systems, photographic recording systems, telemetry receiving systems, and meteorological measurement equipment. Many of the major instrumentation tracking systems are mobile, allowing a large degree of freedom and flexibility to more precisely meet the specific requirements of test engineers. Tests requiring stringent meteorological conditions are normally backed up with test windows on succeeding days. Data gathering and reduction instrumentation and support facilities allow quick look data to be made available to the test engineer on the day of the test.
Author (NSA)

N75-15666# Tracor, Inc., Austin, Tex.
ANALYSIS OF THE 1972 PERFORMANCE OF THE DYNAMIC PREFERENTIAL RUNWAY SYSTEM AT JOHN F. KENNEDY INTERNATIONAL AIRPORT
Richard D. Edmiston Sep. 1974 84 p refs
(Contract DOT-FA71EA-6355)
(AD-787709; TRACOR-T74-AU-9579-U) Avail: NTIS CSCL 01/5

For several years Tracor, Inc., the Federal Aviation Administration, the Port of New York and New Jersey Authority, and the Aviation Development Council of New York have pursued an active program of improving the preferential runway system at John F. Kennedy International Airport (JFK). This effort culminated in the development and installation of a Dynamic Preferential Runway System (DPRS), which was designed to break up long periods of continuous community exposure to aircraft overflight while still distributing overflight among communities as equitably as possible. The installation and operation of the DPRS is described in an earlier report. (AD-787 713). This report presents a quantitative analysis of the effect of the DPRS on operations at JFK for August and September of 1972. (Modified author abstract) GRA

N75-15667# Computer Sciences Corp., Falls Church, Va.
A SUITABILITY STUDY FOR SYSTEM-GENERATED ELECTROMAGNETIC PULSE SIMULATION Final Report, Jan. - Dec. 1973
D. F. Higgins, E. P. Wenaas, and E. P. DePlomb Jun. 1974 90 p refs
(Contract F29601-72-C-0124; AF Proj. 4695)
(AD-787735; CSC-T4-P-108; AFWL-TR-74-86) Avail: NTIS CSCL 14/2

The document describes the rationale employed in the selection of a suitable existing facility for SGEMP simulation. A high-quality SGEMP simulation chamber must satisfy certain requirements dictated by a comparison of the relevant physics of the simulated environment to those of the environment of interest. These requirements were established by the theoretical work reported in the appendixes. Two existing chambers are examined with respect to how well they might be modified to satisfy these requirements. It is concluded that the NASA-Lewis chamber provides some significant advantages over the Arnold Engineering Development Center candidate. Author (GRA)

N75-15668# Pope, Evans, and Robbins, Inc., Alexandria, Va.
DEVELOPMENT OF COAL FIRED FLUIDIZED-BED BOILERS Monthly Progress Reports, Nov. 1968 - Aug. 1969
Oct. 1974 234 p
(Contract DI-14-01-0001-478)
(PB-235899/2; MPR-45-54) Avail: NTIS HC $7.50 CSCL 07A

The report is the second set of a series of progress reports on research concerning coal-fired fluidized bed combustion for steam generation. Air pollution aspects are discussed including limestone injection control efforts and exhaust emissions. Also coal feeding and classification are discussed as well as general performance and design. GRA

N75-15669# Pope, Evans, and Robbins, Inc., Alexandria, Va.
DEVELOPMENT OF COAL FIRED FLUIDIZED-BED BOILERS Monthly Progress Reports, Oct. 1967 - Oct. 1968
Oct. 1974 221 p
(Contract DI-14-01-0001-478)
(PB-235898/4; MPR-32-44) Avail: NTIS HC $7.25 CSCL 07A

The progress reports describe research on a coalburning fluidized bed boiler. Aspects including air pollution control and

exhaust emission, fly ash combustion and carbon loss, coal feeding and classification, and efficiency and design are discussed. GRA

N75-15670# ARO, Inc., Arnold Air Force Station, Tenn.
AN INVESTIGATION OF THREE-DIMENSIONAL WALL INTERFERENCE IN A VARIABLE POROSITY TRANSONIC WIND TUNNEL Final Report, 5 Mar. - 5 Jul. 1973
T. W. Binion, Jr. Oct. 1974 85 p refs
(AF Proj. 222PF; AF Proj. 422PF)
(AD-787658; AEDC-TR-74-76) Avail: NTIS CSCL 14/2

This report presents the results of an experimental program to measure the wall interference effects on an idealized lifting model in the Mach number range from 0.6 to 1.3. The interference phenomena were evaluated by direct comparisons of data obtained in the Propulsion Wind Tunnel (16 T) and the Aerodynamic Wind Tunnel (4 T) at identical test conditions. The results show how a flow angularity which is apparently a function of model attitude and configuration can be induced into the tunnel flow field and be misconstrued as an upwash interference. The porosity schedule currently used in Tunnel 4 T is studied for blockage interference. (Modified author abstract) GRA

N75-15671# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
SOIL STABILIZATION FOR ROADS AND AIRFIELDS IN THE THEATER OF OPERATIONS Final Report
William N. Brabston and George M. Hammitt, II Sep. 1974 205 p refs
(AD-787257; AEWES-Misc-Paper-S-74-23) Avail: NTIS CSCL 13/2

The objective of this study was to develop a design system for the use of chemically stabilized soil layers in pavement systems in the theater of operations. Stabilization with only portland cement, lime, and bituminous materials was considered. Two concepts of construction were envisioned in the development of this system: Expedient and nonexpedient construction. The former involves that type of construction effort to be used when constraints of time, material, equipment, etc., dictate a minimization of efforts. The latter involves that type of construction to be used when constraints are less severe but construction effort would be less than what would be termed deliberate. Procedures are provided for selection of type and quantity of stabilization based on soil type. Thickness design curves are presented for design of single- and multiple-layer pavements for both roads and airfields. Author (GRA)

N75-15672# RAND Corp., Santa Monica, Calif.
AN EXPERIMENTAL INVESTIGATION OF PRIORITY DISPATCHING IN AIRCRAFT MAINTENANCE, USING A SIMPLIFIED MODEL
L. W. Miller, A. S. Ginsburg, and W. L. Maxwell Jun. 1974 34 p refs
(Contract F44620-73-C-0011)
(AD-787881; R-1385-PR) Avail: NTIS CSCL 15/5

An attempt to elucidate the ways in which priority policy affects product completion time. A simple model of a product-assembly (or aircraft-maintenance) shop's processes was created, and products consisting of one or more jobs were fed into it. Three general categories of priority policy were tested: those (a) determined by job length, number of jobs in a product, or total product-processing requirement, (b) determined by status of jobs in a product, and (c) determined by current resource commitments. It turned out that there is a dependence among the choices, i.e., the best choice in (b) varies with the attribute selected in (a). The best procedure among those tried was an unstarted work content rule. That is, give highest priority to the set of waiting jobs whose product has the least sum of processing times. The statistical significance of the experimental results is discussed and a concluding section relates this study to the real world problem that motivated it. Author (GRA)

N75-16293 IBM Italia, Rome.
DIGITAL REAL TIME SIMULATION OF FLIGHT
Nunzio LaFerlita *In* AGARD Real Time Computer Based Systems Dec. 1974 17 p refs (For availability see N75-16257 07-62)

N75-16484* Kanner (Leo) Associates, Redwood City, Calif.
STUDY OF SPARK CHAMBERS FILLED WITH VARIOUS GAS MIXTURES
G. S. Akopyan, N. Kh. Bostandzhyan, G. A. Marikyan, and K. A. Matevosyan *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 308-313 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 199-201 (For availability see N75-16452 07-93) CSCL 14B

N75-16485* Kanner (Leo) Associates, Redwood City, Calif.
A THREE-ELECTRODE STREAMER CHAMBER
N. N. Nurgozhin *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 314-320 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 202-204 (For availability see N75-16452 07-93) CSCL 14B

N75-16486* Kanner (Leo) Associates, Redwood City, Calif.
INCREASING THE ISOTROPIC PROPERTIES OF A DISCHARGE SPARK CHAMBER WITH A LARGE GAP
N. N. Nurgozhin *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 321-326 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 205-207 (For availability see N75-16452 07-93) CSCL 14B

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N75-15673*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PERFORMANCE OF SOLAR SHIELDS
Robert J. Schwinghamer Oct. 1974 42 p Presented at the Amer. Astronaut. Soc. Ann. Meeting, 20-22 Aug. 1974
(NASA-TM-X-64901) Avail: NTIS HC $3.75 CSCL 22C

The loss of the micrometeoroid shield from the Orbital Workshop section of Skylab 1 about 63 seconds after lift-off, was the catalyst for a prodigious effort to develop a substitute for the passive portion of the thermal control system. An intensive effort is described in which numerous potential thermal shield materials were assessed, and during which period ten specific shield designs were developed and carried through various stages of development and test. Thermal shield materials data are discussed, including optical, strength, fatigue, outgassing, tackiness, ultraviolet radiation, and material memory properties. Specifically addressed are thermal shield materials selection criteria and the design, development, and test requirements associated with the successful development of Skylab thermal shields, and specifically the two thermal shields subsequently deployed over the exposed gold foil skin of the Orbital Workshop. Also considered are the general performance and thermal improvements provided by both the parasol design deployed by the Skylab 1 crew, and the sail design deployed by the Skylab 2 crew. Author

N75-15674*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE 1975 REPORT ON ACTIVE AND PLANNED SPACECRAFT AND EXPERIMENTS
Richard Horowitz, ed. and Leo R. Davis, ed. Jan. 1975 315 p refs
(NASA-TM-X-72357; NSSDC/WDC-A-R/S-75-01) Avail: NTIS HC $9.25 CSCL 22A

Information on current as well as planned spacecraft activity in a wide range of scientific disciplines is presented. Brief descriptions for these spacecraft and experiments are included as well as approximate time periods when data are being accumulated. Author

N75-16430* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MISSION OPERATIONS AND DATA SYSTEMS
In its Significant Accomplishments in Sci. and Technol. 1975 p 290-319 (For availability see N75-16422 07-88) CSCL 22A

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N75-15675*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DEVELOPMENT OF A UNIFIED GUIDANCE SYSTEM FOR GEOCENTRIC TRANSFER
James E. Cake and John D. Regetz, Jr. 1975 13 p refs Proposed for presentation at the 11th Elec. Propulsion Conf., New Orleans, 19-21 Mar. 1975; Sponsored by AIAA
(NASA-TM-X-71648; E-8224) Avail: NTIS HC $3.25 CSCL 22A

A method is presented for open loop guidance of a solar electric propulsion spacecraft to geosynchronsus orbit. The method consists of determining the thrust vector profiles on the ground with an optimization computer program, and performing updates based on the difference between the actual trajectory and that predicted with a precision simulation computer program. The motivation for performing the guidance analysis during the mission planning phase is discussed, and a spacecraft design option that employs attitude orientation constraints is presented. The improvements required in both the optimization program and simulation program are set forth, together with the efforts to integrate the programs into the ground support software for the guidance system. Author

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N75-15676# Sandia Labs., Albuquerque, N.Mex.
LAUNCH AND ACCELERATION ENVIRONMENT TESTING: SYSTEMS TEST LABORATORY, SANDIA LABORATORIES
L. M. Spivey Aug. 1974 28 p refs
(Contract AT(29-1)-789)
(SLL-74-0015) Avail: NTIS HC $3.75

The utility of the high-performance centrifuge is demonstrated in connection with the testing of two payloads flown in the FY74 Sandia/ABRES Material Study test program. The test results indicated the importance of a facility capable of closely simulating flight environments. Author (NSA)

N75-15677# Aerospace Corp., San Bernardino, Calif. Reentry Systems Div.
ADVANCED EROSION TEST FACILITIES
R. B. Mortensen 16 Sep. 1974 35 p refs
(Contract F04701-74-C-0075)
(AD-787203; TR-0075(5450-77)-1; SAMSO-TR-74-211) Avail: NTIS CSCL 14/2

This paper describes the major developments in test techniques for hypervelocity erosion in the U.S. since 1970. Techniques in use at that time are described in detail in Ref. 1, and only specific improvements as well as new techniques will be discussed here. The area of hypervelocity erosion has received significantly increased interest since 1970, with resulting improvement in the data quality as well as the overall test capability. Highlights of these areas include: facilities for heating and accurately measuring temperatures (surface) of ballistic range test models, capability to test in a variable, controlled snow/ice field in a ballistic range, successful development of two sounding rocket systems for full size payload launch into natural clouds with subsequent recovery, and development of a new test technique for recovering test models undamaged in a ballistic range. In addition, several test techniques primarily involving rocket motor exhausts with particle injection are in development. GRA

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N75-15678# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
BIFILAR PENDULUM TECHNIQUE FOR DETERMINING MASS PROPERTIES OF DISCOS PACKAGES
R. A. Mattey Jul. 1974 37 p refs
(Contract N00017-72-C-4401)
(AD-787506; APL-TG-1252) Avail: NTIS CSCL 22/2

A bifilar pendulum was used to determine the mass properties of the Discos (Disturbance compensation systems) packages on the Triad satellite. The pendulum design was unique in that it allowed the package to be rotated into six different angular orientations. Each angular position was located with respect to the center of mass of the package. Analysis and results are given that show that the inertia matrix can be completed using the bifilar pendulum. Author (GRA)

N75-16476* Kanner (Leo) Associates, Redwood City, Calif.
THE FEASIBILITY OF CONSTRUCTING A STABILIZING PLATFORM FOR A COSMIC RAY STATION
I. A. Akhmadeyev, V. M. Bednazhevskiy, and E. P. Tolpygin *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 272-278 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 177-180
(For availability see N75-16452 07-93)
CSCL 22B

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

No abstracts in this category.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N75-15679*+ Grumman Aerospace Corp., Bethpage, N.Y.
ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF A

1/8-SCALE DYNAMIC MODEL OF THE SHUTTLE ORBITER. VOLUME 3B: SUPPORTING DATA
P. W. Mason, H. G. Harris, J. Zalesak, and M. Bernstein May 1974 366 p
(Contract NAS1-10635)
(NASA-CR-132491) Avail: NTIS HC $10.00 CSCL 22B

The NASA Structural Analysis System (NASTRAN) Model 1 finite element idealization, input data, and detailed analytical results are presented. The data presented include: substructuring analysis for normal modes, plots of member data, plots of symmetric free-free modes, plots of antisymmetric free-free modes, analysis of the wing, analysis of the cargo doors, analysis of the payload, and analysis of the orbiter. F.O.S.

N75-15680*# Grumman Aerospace Corp., Bethpage, N.Y.
ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF A 1/8-SCALE DYNAMIC MODEL OF THE SHUTTLE ORBITER. VOLUME 1: SUMMARY REPORT
P. W. Mason, H. G. Harris, J. Zalesak, and M. Bernstein May 1974 47 p refs
(Contract NAS1-10635)
(NASA-CR-132488) Avail: NTIS HC $3.75 CSCL 22B

A 1/8-scale structural dynamics model of the space shuttle orbiter was analyzed using the NASA Structural Analysis System (NASTRAN). Comparison of the calculated eigenvalues with preliminary test data for the unrestrained condition indicate that the analytical model was consistently stiffer, being about 20% higher in the first mode. The eigenvectors show reasonably good agreement with test data. A series of analytical and experimental investigations undertaken to resolve the discrepancy are described. Modifications in the NASTRAN model based upon these investigations resulted in close agreement for both eigenvalues and eigenvectors. Author

N75-15681*# Grumman Aerospace Corp., Bethpage, N.Y.
ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF A 1/8-SCALE DYNAMIC MODEL OF THE SHUTTLE ORBITER. VOLUME 2: TECHNICAL REPORT
P. W. Mason, H. G. Harris, J. Zalesak, and M. Bernstein May 1974 357 p refs
(Contract NAS1-10635)
(NASA-CR-132489) Avail: NTIS HC $10.00 CSCL 22B

The methods and procedures used in the analysis and testing of the scale model are reported together with the correlation of the analytical and experimental results. The model, the NASTRAN finite element analysis, and results are discussed. Tests and analytical investigations are also reported. F.O.S.

N75-15682* Grumman Aerospace Corp., Bethpage, N.Y.
ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF A 1/8-SCALE DYNAMIC MODEL OF THE SHUTTLE ORBITER. VOLUME 3A: SUPPORTING DATA
P. W. Mason, H. G. Harris, J. Zalesak, and M. Bernstein May 1974 555 p refs
(Contract NAS1-10635)
(NASA-CR-132480) Avail: NTIS HC $13.00 CSCL 22B
For abstract, see N75-15681.

N75-15683*# Hamilton Standard Div., United Aircraft Corp., Windsor Locks, Conn.
SHUTTLE ENVIRONMENTAL AND THERMAL CONTROL/LIFE SUPPORT SYSTEM COMPUTER PROGRAM Interim Report
Frederick A. Elfers and William J. Ayotte Dec. 1974 66 p
(Contract NAS9-12411)
(NASA-CR-141564; SVHSER-6529) Avail: NTIS HC $4.25 CSCL 22B

Computer programs developed to simulate the RSECS (representative shuttle environmental control system) are described. These programs were prepared to provide pretest predictions, post-test analysis and real-time problem analysis for RSECS test planning and evaluation. These programs are on a magnetic tape cassette and on a disc device that is part of the WANG-2200 series computer system. Author

N75-15684*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DRAG AND STABILITY CHARACTERISTICS OF A VARIETY OF REEFED AND UNREEFED PARACHUTE CONFIGURATIONS AT MACH 1.80 WITH AN EMPIRICAL CORRELATION FOR SUPERSONIC MACH NUMBERS
Lana M. Couch Washington Feb. 1975 109 p refs
(NASA-TR-R-429; L-9265) Avail: NTIS HC $5.25 CSCL 01C

An investigation was conducted at Mach 1.80 in the Langley 4-foot supersonic pressure tunnel to determine the effects of variation in reefing ratio and geometric porosity on the drag and stability characteristics of four basic canopy types deployed in the wake of a cone-cylinder forebody. The basic designs included cross, hemisflo, disk-gap-band, and extended-skirt canopies; however, modular cross and standard flat canopies and a ballute were also investigated. An empirical correlation was determined which provides a fair estimation of the drag coefficients in transonic and supersonic flow for parachutes of specified geometric porosity and reefing ratio. Author

N75-15685*# TRW Systems Group, Redondo Beach, Calif.
ORBIT/LAUNCH VEHICLE TRADEOFF STUDIES. EARTH OBSERVATORY SATELLITE SYSTEM DEFINITION STUDY (EOS) Final Report
1 Oct. 1974 112 p
(Contract NAS5-20519)
(NASA-CR-143639; TRW-22296-6001-RU-000; FR-1) Avail: NTIS HC $5.25 CSCL 22B

An evaluation of the Earth Observatory Satellite (EOS) design, performance, and cost factors which affect the choices of an orbit and a launch vehicle is presented. Primary emphasis is given to low altitude (300 to 900 nautical miles) land resources management applications for which payload design factors are defined. The subjects considered are: (1) a mission model, (2) orbit analysis and characterization, (3) characteristics and capabilities of candidate conventional launch vehicles and space shuttle support. Recommendations are submitted for the EOS-A mission, the Single Multispectral Scanner payload, the Single Multispectral Scanner plus Thematic Mapper payload, the Dual Multispectral Scanner payload, and the Dual Multispectral Scanner plus Thematic Mapper payload. Author

N75-15686*# TRW Systems Group, Redondo Beach, Calif.
INSTRUMENT CONSTRAINTS AND INTERFACE SPECIFICATIONS. EARTH OBSERVATORY SATELLITE SYSTEM DEFINITION STUDY (EOS) Final Report
1 Oct. 1974 148 p
(Contract NAS5-20519)
(NASA-CR-143640; TRW-22296-6001-RU-001; FR-2) Avail: NTIS HC $5.75 CSCL 22B

The equipment specifications for the thematic mapper and high resolution pointable imager for use on the Earth Observatory Satellite (EOS) are presented. The interface requirements of the systems are defined. The interface requirements are extracted from the equipment specifications and are intended as a summary to be used by the system and spacecraft designer. The appropriate documentation from which the specifications of the equipment are established are identified. Author

N75-15687*# TRW Systems Group, Redondo Beach, Calif.
DESIGN/COST TRADEOFF STUDIES. EARTH OBSERVATORY SATELLITE SYSTEM DEFINITION STUDY (EOS) Final Report
1 Oct. 1974 387 p
(Contract NAS5-20519)
(NASA-CR-143641; TRW-22296-6001-RU-002; FR-3) Avail: NTIS HC $10.25 CSCL 22B

The results of design/cost tradeoff studies conducted during the Earth Observatory Satellite system definition studies are presented. The studies are concerned with the definition of a basic modular spacecraft capable of supporting a variety of operational and/or research and development missions, with the deployment either by conventional launch vehicles or by means of the space shuttle. The three levels investigated during the study are: (1) subsystem tradeoffs, (2) spacecraft tradeoffs, and (3) system tradeoffs. The range of requirements which the modular concept must span is discussed. The mechanical, thermal, power, data and electromagnetic compatibility aspects of modularity are analyzed. Other data are provided for the observatory design concept, the payloads, integration and test, the ground support equipment, and ground data management systems. Author

N75-15688*# TRW Systems Group, Redondo Beach, Calif.
DESIGN/COST TRADEOFF STUDIES. APPENDIX A. SUPPORTING ANALYSES AND TRADEOFFS, BOOK 1. EARTH OBSERVATORY SATELLITE SYSTEM DEFINITION STUDY (EOS) Final Report
1 Oct. 1974 488 p
(Contract NAS5-20519)
(NASA-CR-143642; TRW-22296-6001-RU-002-A-1; FR-3) Avail: NTIS HC $12.00 CSCL 22B

A listing of the Earth Observatory Satellite (EOS) candidate missions is presented for use as a baseline in describing the EOS payloads. The missions are identified in terms of first, second, and third generation payloads. The specific applications of the EOS satellites are defined. The subjects considered are: (1) orbit analysis, (2) space shuttle interfaces, (3) thematic mapping subsystem, (4) high resolution pointable imager subsystem, (5) the data collection system, (6) the synthetic aperture radar, (7) the passive multichannel microwave radiometer, and (8) the wideband communications and handling equipment. Illustrations of the satellite and launch vehicle configurations are provided. Block diagrams of the electronic circuits are included. Author

N75-15689*# TRW Systems Group, Redondo Beach, Calif.
DESIGN/COST TRADEOFF STUDIES. APPENDIX A. SUPPORTING ANALYSES AND TRADEOFFS, BOOK 2. EARTH OBSERVATORY SATELLITE SYSTEM DEFINITION STUDY (EOS) Final Report
1 Oct. 1974 678 p
(Contract NAS5-20519)
(NASA-CR-143643; TRW-22296-6001-RU-002-A-2; FR-3) Avail: NTIS HC $15.25 CSCL 22B

Attitude reference systems for use with the Earth Observatory Satellite (EOS) are described. The systems considered are fixed and gimbaled star trackers, star mappers, and digital sun sensors. Covariance analyses were performed to determine performance for the most promising candidate in low altitude and synchronous orbits. The performance of attitude estimators that employ gyroscopes which are periodically updated by a star sensor is established by a single axis covariance analysis. The other systems considered are: (1) the propulsion system design, (2) electric power and electrical integration, (3) thermal control, (4) ground data processing, and (5) the test plan and cost reduction aspects of observatory integration and test. Author

N75-15690*# TRW Systems Group, Redondo Beach, Calif.
MANAGEMENT APPROACH RECOMMENDATIONS. EARTH OBSERVATORY SATELLITE SYSTEM DEFINITION STUDY (EOS) Final Report
1 Oct. 1974 61 p
(Contract NAS5-20519)
(NASA-CR-143644; TRW-22296-6001-RU-003; FR-4) Avail: NTIS HC $4.25 CSCL 22B

Management analyses and tradeoffs were performed to determine the most cost effective management approach for the Earth Observatory Satellite (EOS) Phase C/D. The basic objectives of the management approach are identified. Some of the subjects considered are as follows: (1) contract startup phase, (2) project management control system, (3) configuration management, (4) quality control and reliability engi ring requirements, and (5) the parts procurement program. Author

N75-15691*# TRW Systems Group, Redondo Beach, Calif.
SYSTEM DESIGN AND SPECIFICATIONS. EARTH OBSERVATORY SATELLITE SYSTEM DEFINITION STUDY (EOS) Final Report
11 Nov. 1974 417 p
(Contjact NAS5-20519)
(NASA-CR-143645; TRW-22296-6001-RU-004; FR-5) Avail: NTIS HC $10.50 CSCL 22B

A design summary of the Earth Observatory Satellite (EOS) is presented. The systems considered in the summary are: (1) the spacecraft structure, (2) electrical power modules, (3) communications and data handling module, (4) attitude determination module, (5) actuation module, and (6) solar array and drive module. The documents which provide the specifications for the systems and the equipment are identified. Author

N75-15692*# TRW Systems Group, Redondo Beach, Calif.
SPACE-SHUTTLE INTERFACES/UTILIZATION. EARTH OBSERVATORY SATELLITE SYSTEM DEFINITION STUDY (EOS) Final Report
11 Nov. 1974 169 p refs
(Contract NAS5-20519)
(NASA-CR-143646; TRW-22296-6001-RU-005; FR-6) Avail: NTIS HC $6.25 CSCL 22B

The economic aspects of space shuttle application to a representative Earth Observatory Satellite (EOS) operational mission in the various candidate Shuttle modes of launch, retrieval, and resupply are discussed. System maintenance of the same mission capability using a conventional launch vehicle is also considered. The studies are based on application of sophisticated Monte Carlo mission simulation program developed originally for studies of in-space servicing of a military satellite system. The program has been modified to permit evaluation of space shuttle application to low altitude EOS missions in all three modes. The conclusions generated by the EOS system study are developed. Author

N75-15693*# TRW Systems Group, Redondo Beach, Calif.
SYSTEMS DEFINITION SUMMARY. EARTH OBSERVATORY SATELLITE SYSTEM DEFINITION STUDY (EOS) Final Report
6 Dec. 1974 120 p
(Contract NAS5-20519)
(NASA-CR-143647; TRW-22296-6001-RU-006; FR-7) Avail: NTIS HC $5.25 CSCL 22B

A standard spacecraft bus for performing a variety of earth orbit missions in the late 1970's and 1980's is defined. Emphasis is placed on a low-cost, multimission capability, benefitting from the space shuttle system. The subjects considered are as follows: (1) performance requirements, (2) internal interfaces, (3) redundancy and reliability, (4) communications and data handling module design, (5) payload data handling, (6) application of the modular design to various missions, and (7) the verification concept. Author

N75-15694*# General Electric Co., Philadelphia, Pa. Space Div.
EARTH OBSERVATORY SATELLITE SYSTEM DEFINITION STUDY. REPORT 1: ORBIT/LAUNCH VEHICLE TRADE-OFF STUDIES AND RECOMMENDATIONS
15 Jul. 1974 107 p
(Contract NAS5-20518)
(NASA-CR-143648; DOC-74SD4240) Avail: NTIS HC $5.25 CSCL 22B

A summary of the constraints and requirements on the Earth Observatory Satellite (EOS-A) orbit and launch vehicle analysis is presented. The propulsion system (hydrazine) and the launch vehicle (Delta 2910) selected for EOS-A are examined. The rationale for the selection of the recommended orbital altitude of 418 nautical miles is explained. The original analysis was based on the EOS-A mission with the Thematic Mapper and the High Resolution Pointable Imager. The impact of the revised mission model is analyzed to show how the new mission model affects the previously defined propulsion system, launch vehicle, and orbit. A table is provided to show all aspects of the EOS multiple mission concepts. The subjects considered include the following: (1) mission orbit analysis, (2) spacecraft parametric performance analysis, (3) launch system performance analysis, and (4) orbits/launch vehicle selection. Author

N75-15695*# General Electric Co., Philadelphia, Pa. Space Div.
EARTH OBSERVATORY SATELLITE SYSTEM DEFINITION STUDY. REPORT 2: INSTRUMENT CONSTRAINTS AND INTERFACES
15 Jul. 1974 138 p
(Contract NAS5-20518)
(NASA-CR-143649; DOC-74SD4241) Avail: NTIS HC $5.75 CSCL 22B

The instrument constraints and interface specifications for the Earth Observatory Satellite (EOS) are discussed. The Land Use Classification Mission using a 7 band Thematic Mapper and a 4 band High Resolution Pointable Imager is stressed. The mission and performance of the instruments were reviewed and

expanded to reflect the instrument as a part of the total remote sensing system. A preliminary EOS interface handbook is provided to describe the mission and system, to specify the spacecraft interfaces to potential instrument contractors, and to describe the instrument interface data required by the system integration contractor. Author

N75-15696*# General Electric Co., Philadelphia, Pa. Space Div.

EARTH OBSERVATORY SATELLITE SYSTEM DEFINITION STUDY. REPORT 3: DESIGN COST TRADE-OFF STUDIES AND RECOMMENDATIONS

15 Jul. 1974 341 p

(Contract NAS5-20518)

(NASA-CR-143650; DOC-74SD4242) Avail: NTIS HC $9.50 CSCL 22B

An analysis of the design and cost tradeoff aspects of the Earth Observatory Satellite (EOS) development is presented. The design/cost factors that affect a series of mission/system level concepts are discussed. The subjects considered are as follows: (1) spacecraft subsystem cost tradeoffs, (2) ground system cost tradeoffs, and (3) program cost summary. Tables of data are provided to summarize the results of the analyses. Illustrations of the various spacecraft configurations are included. Author

N75-15697*# General Electric Co., Philadelphia, Pa. Space Div.

EARTH OBSERVATORY SATELLITE SYSTEM DEFINITION STUDY. REPORT 4: LOW COST MANAGEMENT APPROACH AND RECOMMENDATIONS

15 Jul. 1974 74 p

(Contract NAS5-20518)

(NASA-CR-143651; DOC-74SD4243) Avail: NTIS HC $4.25 CSCL 22B

An analysis of low cost management approaches for the development of the Earth Observatory Satellite (EOS) is presented. The factors of the program which tend to increase costs are identified. The NASA/Industry interface is stressed to show how tye interface can be improved to produce reduced program costs. Techniques and examples of cost reduction which can be applied to the EOS program are tabulated. Specific recommendations for actions to be taken to reduce costs in prescribed areas are submitted. Author

N75-15698*# General Electric Co., Philadelphia, Pa. Space Div.

EARTH OBSERVATORY SATELLITE SYSTEM DEFINITION STUDY. REPORT 5: SYSTEM DESIGN AND SPECIFICATIONS. VOLUME 1: BASELINE SYSTEM DESCRIPTION

16 Sep. 1974 447 p

(Contract NAS5-20518)

(NASA-CR-143652; DOC-74SD4249-Vol-1) Avail: NTIS HC $11.25 CSCL 22B

A system baseline design oriented to the requirements of the next generation of Earth Observatory Satellite missions is presented. The first mission (EOS-A) is envisioned as a two-fold mission which (1) provides a continuum of data of the type being supplied by ERTS for the emerging operational applications and also (2) expands the research and development activities for future instrumentation and analysis techniques. The baseline system specifically satisfies the requirements of this first mission. However, EOS-A is expected to be the first of a series of earth observation missions. Thus the baseline design has been developed so as to accommodate these latter missions effectively as the transition is made from conventional, expendable launch vehicles and spacecraft to the Shuttle Space Transportation System era. Further, a subset of alternative missions requirements including Seasat, SEOS, SMM and MSS-5 have been analyzed to verify that the spacecraft design to serve a multi-mission role is economically sound. A key feature of the baseline system design is the concept of a modular observatory system whose elements are compatible with varying levels of launch vehicle capability. The design configuration can be used with either the Delta or Titan launch vehicles and will adapt readily to the space shuttle when that system becomes available in the early 1980's. Author

N75-15699*# General Electric Co., Philadelphia, Pa. Space Div.

EARTH OBSERVATORY SATELLITE SYSTEM DEFINITION STUDY. REPORT 5: SYSTEM DESIGN AND SPECIFICATIONS. VOLUME 2: EOS-A SYSTEM SPECIFICATION

16 Sep. 1974 57 p

(Contract NAS5-20518)

(NASA-CR-143653; DOC-74SD4249-Vol-2) Avail: NTIS HC $4.25 CSCL 22B

The objectives of the Earth Observatory Satellite (EOS) program are defined. The system specifications for the satellite payload are examined. The broad objectives of the EOS-A program are as follows: (1) to develop space-borne sensors for the measurement of land resources, (2) to evolve spacecraft systems and subsystems which will permit earth observation with greater accuracy, coverage, spatial resolution, and continuity than existing systems, (3) to develop improved information processing, extraction, display, and distribution systems, and (4) to use space transportation systems for resupply and retrieval of the EOS. Author

N75-15700*# General Electric Co., Philadelphia, Pa. Space Div.

EARTH OBSERVATORY SATELLITE SYSTEM DEFINITION STUDY. REPORT 5: SYSTEM DESIGN AND SPECIFICATIONS. VOLUME 3: GENERAL PURPOSE SPACECRAFT SEGMENT AND MODULE SPECIFICATIONS

16 Sep. 1974 425 p

(Contract NAS5-20518)

(NASA-CR-143654; DOC-74SD4249-Vol-3) Avail: NTIS HC $10.50 CSCL 22B

The specifications for the Earth Observatory Satellite (EOS) general purpose aircraft segment are presented. The satellite is designed to provide attitude stabilization, electrical power, and a communications data handling subsystem which can support various mission peculiar subsystems. The various specifications considered include the following: (1) structures subsystem, (2) thermal control subsystem, (3) communications and data handling subsystem module, (4) attitude control subsystem module, (5) power subsystem module, and (6) electrical integration subsystem. Author

N75-15701*# General Electric Co., Philadelphia, Pa. Space Div.

EARTH OBSERVATORY SATELLITE SYSTEM DEFINITION STUDY. REPORT 5: SYSTEM DESIGN AND SPECIFICATIONS. VOLUME 4: MISSION PECULIAR SPACECRAFT SEGMENT AND MODULE SPECIFICATIONS

16 Sep. 1974 164 p

(Contract NAS5-20518)

(NASA-CR-143655; DOC-74SD4249-Vol-4) Avail: NTIS HC $6.25 CSCL 22B

The specifications for the Earth Observatory Satellite (EOS) peculiar spacecraft segment and associated subsystems and modules are presented. The specifications considered include the following: (1) wideband communications subsystem module, (2) mission peculiar software, (3) hydrazine propulsion subsystem module, (4) solar array assembly, and (5) the scanning spectral radiometer. Author

N75-15702*# General Electric Co., Philadelphia, Pa. Space Div.

EARTH OBSERVATORY SATELLITE SYSTEM DEFINITION STUDY. REPORT 5: SYSTEM DESIGN AND SPECIFICATIONS. VOLUME 5: SPECIFICATION FOR EROS OPERATIONS CONTROL CENTER

16 Sep. 1974 71 p

(Contract NAS5-20518)

(NASA-CR-143656; DOC-74SD4249-Vol-5) Avail: NTIS HC $4.25 CSCL 22B

The functional, performance, and design requirements for the Operations Control Center (OCC) of the Earth Observatory Satellite (EOS) system are presented. The OCC controls the operations of the EOS satellite to acquire mission data consisting of: (1) thematic mapper data, (2) multispectral scanner data on EOS-A, or High Resolution Pointable Imager data on EOS-B, and (3) data collection system (DCS) data. The various inputs to the OCC are identified. The functional requirements of the

OCC are defined. The specific systems and subsystems of the OCC are described and block diagrams are provided. Author

N75-15703*# General Electric Co., Philadelphia, Pa. Space Div.
EARTH OBSERVATORY SATELLITE SYSTEM DEFINITION STUDY. REPORT 5: SYSTEM DESIGN AND SPECIFICATIONS. VOLUME 6: SPECIFICATION FOR EOS CENTRAL DATA PROCESSING FACILITY (CDPF)
16 Sep. 1974 50 p
(Contract NAS5-20518)
(NASA-CR-143657; DOC-74SD4249-Vol-6) Avail: NTIS HC $3.75 CSCL 22B

The specifications and functions of the Central Data Processing (CDPF) Facility which supports the Earth Observatory Satellite (EOS) are discussed. The CDPF will receive the EOS sensor data and spacecraft data through the Spaceflight Tracking and Data Network (STDN) and the Operations Control Center (OCC). The CDPF will process the data and produce high density digital tapes, computer compatible tapes, film and paper print images, and other data products. The specific aspects of data inputs and data processing are identified. A block diagram of the CDPF to show the data flow and interfaces of the subsystems is provided. Author

N75-15704*# General Electric Co., Philadelphia, Pa. Space Div.
EARTH OBSERVATORY SATELLITE SYSTEM DEFINITION STUDY. REPORT 5: SYSTEM DESIGN AND SPECIFICATIONS. VOLUME 7: SPECIFICATION FOR EOS LOW COST READOUT STATION
16 Sep. 1974 33 p
(Contract NAS5-20518)
(NASA-CR-143658; DOC-74SD4249-Vol-7) Avail: NTIS HC $3.75 CSCL 22B

The functional, performance, and design requirements for the Low Cost Readout Station (LCRS) which supports the Earth Observatory Satellite (EOS) data system are described. The basic LCRS consists of all hardware and software needed to acquire and track the EOS-A or EOS-B satellite and receive, record, process, and annotate the instrument data from the satellites. The LCRS also provides appropriate interfaces with the unique local user provided display and extractive processing equipment. The LCRS has the capability of acquiring image data from the EOS-A and the EOS-B satellites over a ground area defines by a 500 kilometer radius from the coordinates of the station. The LCRS is also capable of receiving and processing both, but not simultaneously, full five band Multispectral Scanner (MSS) image data and various modes of the Compacted Thematic (CTM) data. Author

N75-15705*# General Electric Co., Philadelphia, Pa. Space Div.
EARTH OBSERVATORY SATELLITE SYSTEM DEFINITION STUDY. REPORT 6: SPACE SHUTTLE INTERFACES/UTILIZATION
16 Sep. 1974 137 p
(Contract NAS5-20518)
(NASA-CR-143659; DOC-74SD4250) Avail: NTIS HC $5.75 CSCL 22B

An analysis was conducted to determine the compatibility of the Earth Observatory Satellite (EOS) with the space shuttle. The mechanical interfaces and provisions required for a launch or retrieval of the EOS by the space shuttle are summarized. The space shuttle flight support equipment required for the operation is defined. Diagrams of the space shuttle in various configurations are provised to show the mission capability with the EOS. The subjects considered are as follows: (1) structural and mechanical interfaces, (2) spacecraft retention and deployment, (3) spacecraft retrieval, (4) electrical interfaces, (5) payload shuttle operations, (6) shuttle mode cost analysis, (7) shuttle orbit trades, and (8) safety considerations. Author

N75-15706*# General Electric Co., Philadelphia, Pa. Space Div.
EARTH OBSERVATORY SATELLITE SYSTEM DEFINITION STUDY. REPORT 7: EOS SYSTEM DEFINITION REPORT
15 Oct. 1974 91 p
(Contract NAS5-20518)
(NASA-CR-143660; DOC-74SD4262) Avail: NTIS HC $4.75 CSCL 22B

The Earth Observatory Satellite (EOS) study is summarized to show the modular design of a general purpose spacecraft, a mission peculiar segment which performs the EOS-A mission, an Operations Control Center, a Data Processing Facility, and a design for Low Cost Readout Stations. The study verified the practicality and feasibility of the modularized spacecraft with the capability of supporting many missions in the Earth Observation spectrum. The various subjects considered in the summary are: (1) orbit/launch vehicle tradeoff studies and recommendations, (2) instrument constraints and interfaces, (3) design/cost tradeoff and recommendations, (4) low cost management approach and recommendations, (5) baseline system description and specifications, and (6) space shuttle utilization and interfaces. Author

N75-15707*# Grumman Aerospace Corp., Bethpage, N.Y.
EARTH OBSERVATORY SATELLITE SYSTEM DEFINITION STUDY. REPORT NO. 1: ORBIT/LAUNCH VEHICLE TRADEOFF STUDIES AND RECOMMENDATIONS
Sep. 1974 93 p refs
(Contract NAS5-20520)
(NASA-CR-143661) Avail: NTIS HC $4.75 CSCL 22B

A study was conducted to determine the recommended orbit for the Earth Observatory Satellite (EOS) Land Resources Mission. It was determined that a promising sun synchronous orbit is 366 nautical miles when using an instrument with a 100 nautical mile swath width. The orbit has a 17 day repeat cycle and a 14 nautical mile swath overlap. Payloads were developed for each mission, EOS A through F. For each mission, the lowest cost booster that was capable of lifting the payload to the EOS orbit was selected. The launch vehicles selected for the missions are identified on the basis of tradeoff studies and recommendations. The reliability aspects of the launch vehicles are analyzed. Author

N75-15708*# Grumman Aerospace Corp., Bethpage, N.Y.
EARTH OBSERVATORY SATELLITE SYSTEM DEFINITION STUDY. REPORT NO. 2: INSTRUMENT CONSTRAINTS AND INTERFACE SPECIFICATIONS
Sep. 1974 167 p refs
(Contract NAS5-20520)
(NASA-CR-143662) Avail: NTIS HC $4.25 CSCL 22B

The instruments to be flown on the Earth Observatory Satellite (EOS) system are defined. The instruments will be used to support the Land Resources Management (LRM) mission of the EOS. Program planning information and suggested acquisition activities for obtaining the instruments are presented. The subjects considered are as follows: (1) the performance and interface of the Thematic Mapper (TM) and the High Resolution Pointing Imager (HRPI), (2) procedure for interfacing the TM and HRPI with the EOS satellite, (3) a space vehicle integration plan suggesting the steps and sequence of events required to carry out the interface activities, and (4) suggested agreements between the contractors for providing timely and equitable solution of problems at minimum cost. Author

N75-15709*# Grumman Aerospace Corp., Bethpage, N.Y.
EARTH OBSERVATORY SATELLITE SYSTEM DEFINITION STUDY. REPORT NO. 3: DESIGN/COST TRADEOFF STUDIES
Sep. 1974 439 p
(Contract NAS5-20520)
(NASA-CR-143663) Avail: NTIS HC $11.25 CSCL 22B

The key issues in the Earth Observatory Satellite (EOS) program which are subject to configuration study and tradeoff are identified. The issue of a combined operational and research and development program is considered. It is stated that cost and spacecraft weight are the key design variables and design options are proposed in terms of these parameters. A cost analysis of the EOS program is provided. Diagrams of the satellite configuration and subsystem components are included. Author

N75-15710*# Grumman Aerospace Corp., Bethpage, N.Y.
EARTH OBSERVATORY SATELLITE SYSTEM DEFINITION STUDY. REPORT NO. 3: DESIGN/COST TRADEOFF STUDIES. APPENDIX A: EOS PROGRAM WBS DIC-

TIONARY. APPENDIX B: EOS MISSION FUNCTIONAL ANALYSIS
Sep. 1974 103 p
(Contract NAS5-20520)
(NASA-CR-143664) Avail: NTIS HC $5.25 CSCL 22B

The work breakdown structure (WBS) dictionary for the Earth Observatory Satellite (EOS) is defined. The various elements of the EOS program are examined to include the aggregate of hardware, computer software, services, and data required to develop, produce, test, support, and operate the space vehicle and the companion ground data management system. A functional analysis of the EOS mission is developed. The operations for three typical EOS missions, Delta, Titan, and Shuttle launched are considered. The functions were determined for the top program elements, and the mission operations, function 2.0, was expanded to level one functions. Selection of ten level one functions for further analysis to level two and three functions were based on concern for the EOS operations and associated interfaces.
Author

N75-15711*# Grumman Aerospace Corp., Bethpage, N.Y.
EARTH OBSERVATORY SATELLITE SYSTEM DEFINITION STUDY. REPORT NO. 3: DESIGN/COST TRADEOFF STUDIES. APPENDIX C: EOS PROGRAM REQUIREMENTS DOCUMENT
Sep. 1974 162 p
(Contract NAS5-20520)
(NASA-CR-143665) Avail: NTIS HC $6.25 CSCL 22B

An analysis of the requirements for the Earth Observatory Satellite (EOS) system specifications is presented. The analysis consists of requirements obtained from existing documentation and those derived from functional analysis. The requirements follow the hierarchy of program, mission, system, and subsystem. The code for designating specific requirements is explained. Among the subjects considered are the following: (1) the traffic model, (2) space shuttle related performance, (3) booster related performance, (4) the data collection system, (5) spacecraft structural tests, and (6) the ground support requirements.
Author

N75-15712*# Grumman Aerospace Corp., Bethpage, N.Y.
EARTH OBSERVATORY SATELLITE SYSTEM DEFINITION STUDY. REPORT NO. 3: DESIGN/COST TRADEOFF STUDIES. APPENDIX D: EOS CONFIGURATION DESIGN DATA. PART 1: SPACECRAFT CONFIGURATION
Sep. 1974 335 p refs
(Contract NAS5-20520)
(NASA-CR-143666) Avail: NTIS HC $9.50 CSCL 22B

The results of structural studies of the Earth Observatory Satellite (EOS) which define the member sizes to meet the vehicle design requirements are presented. The most significant requirements in sizing the members are the stiffness required to meet the launch vehicle design frequencies both in the late al and in the longitudinal directions. The selected configurations, both baseline and preferred, for the Delta and Titan launch vehicles were evaluated for stiffness requirements. The structural idealization used to estimate the stiffness of each structural arrangement, was based on an evaluation of primary loads paths, effectivity of structural members, and estimated sizes for the preferred configurations. The study included an evaluation of the following structural materials: (1) aluminum alloys, (2) titanium alloys, (3) beryllium, (4) beryllium/aluminum alloy, and (5) composite materials.
Author

N75-15713*# Grumman Aerospace Corp., Bethpage, N.Y.
EARTH OBSERVATORY SATELLITE SYSTEM DEFINITION STUDY. REPORT NO. 3: DESIGN/COST TRADEOFF STUDIES. APPENDIX D: EOS CONFIGURATION DESIGN DATA. PART 2: DATA MANAGEMENT SYSTEM CONFIGURATION
Sep. 1974 164 p
(Contract NAS5-20520)
(NASA-CR-143667) Avail: NTIS HC $6.25 CSCL 22B

The Earth Observatory Satellite (EOS) data management system (DMS) is discussed. The DMS is composed of several subsystems or system elements which have basic purposes and are connected together so that the DMS can support the EOS program by providing the following: (1) payload data acquisition and recording, (2) data processing and product generation, (3) spacecraft and processing management and control, anp (4) data user services. The configuration and purposes of the primary or high-data rate system and the secondary or local user system are explained. Diagrams of the systems are provided to support the systems analysis.
Author

N75-15714*# Grumman Aerospace Corp., Bethpage, N.Y.
EARTH OBSERVATORY SATELLITE SYSTEM DEFINITION STUDY. REPORT NO. 3: DESIGN/COST TRADEOFF STUDIES. APPENDIX E: EOS PROGRAM SUPPORTING SYSTEM. PART 1: SYSTEM TRADE STUDIES NO. 1 THROUGH 8
Sep. 1974 255 p refs
(Contract NAS5-20520)
(NASA-CR-143668) Avail: NTIS HC $8.50 CSCL 22B

The design requirements and associated cost impacts for using the space shuttle to deliver the Earth Observatory Satellite (EOS) are identified. The additional impact of achieving full compatibility for resupply and retrieval is considered. Based on the results of the analysis, it is concluded that the EOS-Shuttle compatibility can be realized with reasonable spacecraft weight and cost penalties. Inherent space shuttle capabilities are adequate to meet the requirements of all missions except E and F. Mission E (Tiros 0) may be accommodated by either an EOS orbit transfer capability or a tug. The tug appears to be the only viable approach to satisfying the mission F (SEOS) requirements.
Author

N75-15715*# Grumman Aerospace Corp., Bethpage, N.Y.
EARTH OBSERVATORY SATELLITE SYSTEM DEFINITION STUDY. REPORT NO. 3: DESIGN/COST TRADEOFF STUDIES. APPENDIX E: EOS PROGRAM SUPPORTING SYSTEM TRADE DATA. PART 2: SYSTEM TRADE STUDIES NO. 9 - 19
Sep. 1974 157 p refs
(Contract NAS5-20520)
(NASA-CR-143669) Avail: NTIS HC $6.25 CSCL 22B

The relative merits of several international data acquisition (IDA) alternatives for the Earth Observatory Satellite (EOS) are established and rated on a cost effectiveness basis. The primary alternatives under consideration are: (1) direct transmission to foreign ground stations, (2) a wideband video tape recorder system for collection of foreign data and processing and distribution from the United States, and (3) a tracking and data relay satellite (TDRS) system for the relay of foreign data to the United States for processing and distribution. A requirements model is established for the analysis on the basis of the heaviest concentration of agricultural areas around the world. The model, the orbit path and the constraints of EOS and data volume summaries are presented. Alternative system descriptions and costs are given in addition to cost-performance summaries.
Author

N75-15716*# Grumman Aerospace Corp., Bethpage, N.Y.
EARTH OBSERVATORY SATELLITE SYSTEM DEFINITION STUDY. REPORT NO. 4: MANAGEMENT APPROACH RECOMMENDATIONS
Sep. 1974 87 p
(Contract NAS5-20520)
(NASA-CR-143670) Avail: NTIS HC $4.75 CSCL 22B

A management approach for the Earth Observatory Satellite (EOS) which will meet the challenge of a constrained cost environment is presented. Areas of consideration are contracting techniques, test philosophy, reliability and quality assurance requirements, commonality options, and documentation and control requirements. The various functional areas which were examined for cost reduction possibilities are identified. The recommended management approach is developed to show the primary and alternative methods.
Author

N75-15717*# Grumman Aerospace Corp., Bethpage, N.Y.
EARTH OBSERVATORY SATELLITE SYSTEM DEFINITION STUDY. REPORT NO. 5: SYSTEM DESIGN AND SPECIFICATIONS. PART 1: OBSERVATORY SYSTEM ELEMENT SPECIFICATIONS
Oct. 1974 288 p refs
(Contract NAS5-20520)
(NASA-CR-143671) Avail: NTIS HC $8.75 CSCL 22B

The performance, design, and quality assurance requirements for the Earth Observatory Satellite (EOS) Observatory and Ground System program elements required to perform the Land Resources Management (LRM) A-type mission are presented. The requirements for the Observatory element with the exception of the instruments specifications are contained in the first part. Author

N75-15718*# Grumman Aerospace Corp., Bethpage, N.Y.
EARTH OBSERVATORY SATELLITE SYSTEM DEFINITION STUDY. REPORT NO. 5: SYSTEM DESIGN AND SPECIFICATIONS. PART 2: GROUND SYSTEM ELEMENT SPECIFICATIONS
Oct. 1974 140 p
(Contract NAS5-20520)
(NASA-CR-143672) Avail: NTIS HC $5.75 CSCL 22B

The Ground System requirements for the Land Resources Management (LRM) type-A and type-B missions of the Earth Observatory Satellite (EOS) program are presented. Specifications for the Thematic Mapper data processing are provided (LRM A mission). The specifications also cover the R and D instruments (Thematic Mapper and High Resolution Pointable Imager) data processing for the LRM type-B mission. Author

N75-15719*# Grumman Aerospace Corp., Bethpage, N.Y.
EARTH OBSERVATORY SATELLITE SYSTEM DEFINITION STUDY. REPORT NO. 6: SPACE SHUTTLE INTERFACES/UTILIZATION
Oct. 1974 184 p refs
(Contract NAS5-20520)
(NASA-CR-143673) Avail: NTIS HC $7.00 CSCL 22B

The impacts of achieving compatibility of the Earth Observatory Satellite (EOS) with the space shuttle and the potential benefits of space shuttle utilization are discussed. Mission requirements and mission suitability, including the effects of multiple spacecraft missions, are addressed for the full spectrum of the missions. Design impact is assessed primarily against Mission B, but unique requirements reflected by Mission A, B, and C are addressed. The preliminary results indicated that the resupply mission had the most pronounced impact on spacecraft design and cost. Program costs are developed for the design changes necessary to achieve EOS-B compatibility with Space Shuttle operations. Non-recurring and recurring unit costs are determined, including development, test, ground support and logistics, and integration efforts. Mission suitability is addressed in terms of performance, volume, and center of gravity compatibility with both space shuttle and conventional launch vehicle capabilities. Author

N75-15720*# Grumman Aerospace Corp., Bethpage, N.Y.
EARTH OBSERVATORY SATELLITE SYSTEM DEFINITION STUDY. REPORT NO. 7: EOS SYSTEM DEFINITION REPORT
Nov. 1974 228 p
(Contract NAS5-20520)
(NASA-CR-143674) Avail: NTIS HC $7.50 CSCL 22B

The design concept and operational aspects of the Earth Observatory Satellite (EOS) are presented. A table of the planned EOS missions is included to show the purpose of the mission, the instruments involved, and the launch date. The subjects considered in the analysis of the EOS development are: (1) system requirements, (2) design/cost trade methodology, (3) observatory design alternatives, (4) the data management system, (5) the design evaluation and preferred approach, (6) program cost compilation, (7) follow-on mission accommodation, and (8) space shuttle interfaces and utilization. Illustrations and block diagrams of the spacecraft configurations are provided. Author

N75-15721*# Grumman Aerospace Corp., Bethpage, N.Y.
EARTH OBSERVATORY SATELLITE SYSTEM DEFINITION STUDY. REPORT NO. 7: EOS SYSTEM DEFINITION REPORT. APPENDIXES A THROUGH D
Sep. 1974 199 p refs
(Contract NAS5-20520)
(NASA-CR-143675) Avail: NTIS HC $7.00 CSCL 22B

An analysis of the systems involved in the operation and support of the Earth Observatory Satellite (EOS) is presented. Among the systems considered are the following: (1) the data management system, (2) observatory to primary ground station communications links, (3) local user system, (4) techniques for recognizing ground control points, (5) the central data processing-implementation concept, and (6) program effectiveness analysis. Author

N75-15722*# Chrysler Corp., New Orleans, La.
HEAT TRANSFER TESTS OF A 0.0175-SCALE SPACE SHUTTLE ORBITER MODEL (29-0) TO DETERMINE THE EFFECT OF SURFACE TEMPERATURE ON BOUNDARY LAYER TRANSITION AT MACH 8.0 IN THE AEDC VKF TUNNEL B (TEST OH4A)
J. W. Foust Jan. 1975 122 p refs Prepared by Rockwell Intern. Corp.
(Contract NAS9-13247)
(NASA-CR-134437; DMS-DR-2154) Avail: NTIS HC $5.25 CSCL 22B

Wind tunnel tests were conducted to determine the heat transfer characteristics of a 0.0175-scale model of the space shuttle orbiter and to analyze the effect of wall temperature on the point of boundary layer transition. The tests were conducted at Mach 8.0 over a range of Reynolds numbers from 1.0 to 3.7 million per foot. Two regions of initial model wall temperature were investigated. Eighteen runs were obtained at each region to support the test objectives. Tabulated data are presented along with a description of the test procedure. Preliminary data indicated that the initial model wall temperature did not obviously affect the point of boundary layer transition. Author

N75-15723*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF INVESTIGATIONS (OA77 AND OA78) ON AN 0.015-SCALE 140A/B CONFIGURATION SPACE SHUTTLE VEHICLE ORBITER MODEL 49-0 IN THE AEDC VKF B AND C WIND TUNNELS, REVISION A
R. L. Gillins (Rockwell Intern., Downey, Calif.) Jan. 1975 701 p refs Revised
(Contract NAS9-13247)
(NASA-CR-134429; DMS-DR-2134-Rev-A) Avail: NTIS HC $17.25 CSCL 22B

Aerodynamic data obtained from wind tunnel tests of an 0.015-scale 140A/B configuration SSV Orbiter model in the AEDC VKF B and C wind tunnels are presented. Tests were conducted at Mach numbers of 6 and 8 in the B tunnel and at a Mach number of 10 to in the C tunnel to verify hypersonic stability and control characteristics, determine control surface effectiveness, and investigate Reynolds number effects of the 140A/B configuration. Force data were obtained for various control surface settings and Reynolds numbers in the angle-of-attack range of 15 deg to 45 deg and at angles of sideslip of -5 deg to +10 deg. Data were obtained for a few configurations at angles of attack from -27 deg to 45 deg. Control surface variables included elevon, rudder, speedbrake and bodyflap deflections. The effects of an alternate wing leading edge shape were investigated to determine its hypersonic stability and control characteristics. Author

N75-15724*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF DIFFERENTIAL ELEVON/AILERON DEFLECTION FOR LATERAL CONTROL OPTIMIZATION AND ELEVON HINGE MOMENT INVESTIGATIONS ON AN 0.015-SCALE MODEL (49-0) OF THE SPACE SHUTTLE ORBITER IN THE NASA/LANGLEY RESEARCH CENTER 8 FOOT TPT (OA116)
A. I. Lindsey (Rockwell Intern. Corp., Downey, Calif.) and M. D. Milam (Rockwell Intern. Corp., Downey, Calif.) Dec. 1974 278 p
(Contract NAS9-13247)
(NASA-CR-134428; DMS-DR-2186) Avail: NTIS HC $8.75 CSCL 22B

Aerodynamic investigations were conducted in a transonic pressure tunnel on an 0.015 scale model of the space shuttle orbiter. Major test objectives were to determine: (1) transonic differential elevon/aileron lateral control optimization; (2) transonic elevon hinge moments; (3) transonic effects of the baseline 6 inch elevon/elevon and elevon/fuselage gaps; and (4) transonic effects of the short OMS pods. Six-component aerodynamic force and moment, and elevon hinge moment data, were recorded over an angle-of-attack range form -2 to +22 degrees. Author

N75-15725*# Lockheed-Georgia Co., Marietta.
PRELIMINARY NONDESTRUCTIVE EVALUATION MANUAL FOR THE SPACE SHUTTLE Final Report, 22 Jun. 1972 - 22 Jul. 1974
W. M. Pless Jul. 1974 478 p refs
(Contract NAS10-8018)
(NASA-CR-139180; LG74ER-0075-App) Avail: NTIS HC $12.00 CSCL 22B

Nondestructive evaluation (NDE) requirements are presented for some 134 potential fracture-critical structural areas identified, for the entire space shuttle vehicle system, as those possibly needing inspection during refurbishment/turnaround and prelaunch operations. The requirements include critical area and defect descriptions, access factors, recommended NDE techniques, and descriptive artwork. Requirements discussed include: Orbiter structure, external tank, solid rocket booster, and thermal protection system (development area). Author

N75-15726*# Lockheed-Georgia Co., Marietta.
SPACE SHUTTLE: STRUCTURAL INTEGRITY AND ASSESSMENT STUDY Final Report, 22 Jun. 1972 - 22 Jul. 1974
W. M. Pless and W. H. Lewis Jul. 1974 90 p refs
(Contract NAS10-8018)
(NASA-CR-134454; LG74ER-0074) Avail: NTIS HC $4.75 CSCL 22B

A study program was conducted to determine the nondestructive evaluation (NDE) requirements and to develop a preliminary nondestructive evaluation manual for the entire space shuttle vehicle. The rationale and guidelines for structural analysis and NDE requirements development are discussed. Recommendations for development of NDE technology for the orbiter thermal protection system and certain structural components are included. Recommendations to accomplish additional goals toward space shuttle inspection are presented. Author

N75-15727# Aeritalia, Turin (Italy). Centro Electronico Avio.
STUDY OF DETECTION AND ESTIMATION TECHNIQUES APPLIED TO ATTITUDE MEASUREMENTS OF SATELLITES. VOLUME 1: SURVEY OF DETECTION AND ESTIMATION TECHNIQUES
D. Sciacovelli and A. Santinelli Apr. 1974 192 p refs Prepared jointly with Officine Galileo 4 Vol.
(Contract ESTEC-1775/72-AA)
(R-1175-CE; ESRO-CR(P)-550) Avail: NTIS HC $7.00

Detection and estimation techniques used in processing satellite attitude sensor signals were investigated and some possible practical applications analyzed in detail. Existing detection and estimation techniques were examined. A general outline of the statistical concepts used in detection and estimation theory, together with the more applicable decision criteria, is presented. Binary and M-ary detection in the presence of known signals in additive noise were considered, with solutions referring to the general Bayesian criterion for binary detection and to the minimum total probability of error criterion for M-ary detection. Linear mean square estimators are emphasized for linear models. In the nonlinear case, the linearization approach of the Kalman filter algorithm was considered. ESRO

N75-15728# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
EXTENDIBLE SPACE STRUCTURES
R. A. Mattey Jun. 1974 48 p refs
(Contract N00017-72-C-4401)
(AD-787512; APL-TG-1244) Avail: NTIS CSCL 22/2

A list is given of all extendible and inflatable structures in space, along with the launching nation. Configurations of the coilable beryllium copper booms are illustrated, as well as associated engineering problems and solutions. Some unique extendible structures such as the Triad boom and coilable extendible structures are described. Author (GRA)

N75-15729# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
SPACECRAFT ATTITUDE STABILIZATION SYSTEMS
L. I. Kargu 9 Sep. 1974 156 p refs Transl. into ENGLISH of the book "Sistemy Uglovoi Stabilizatsii Komicheskikh Apparatov" Moscow, Machine Construction Press, 1973 176 p
(Contract N00017-72-C-4401)
(AD-787808; APL-Trans-2869) Avail: NTIS CSCL 22/2

Various principles underlying the construction of spacecraft attitude stabilization systems are examined in this book. General data are presented on the angular motion and stabilization of spacecraft. The literature devoted to passive stabilization systems, reaction-wheel and control moment gyro stabilization systems, as well as to active stabilization systems using reaction jets is discussed. The book is intended for engineering technicians and scientists engaged in the design, calculation and study of spacecraft stabilization systems. It may be useful to instructors and students of the higher educational institutions. Author (GRA)

N75-16426* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPACECRAFT TECHNOLOGY
In its Significant Accomplishments in Sci. and Technol. 1975 p 139-178 (For availability see N75-16422 07-88)
CSCL 22B

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N75-15730*# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
MULTIPLE IMU SYSTEM HARDWARE INTERFACE DESIGN, VOLUME 2
Martin Landey and David Brown 12 Feb. 1975 79 p refs
(Contract NAS8-27624)
(NASA-CR-120568; R-798-Vol-2) Avail: NTIS HC $4.75 CSCL 22B

The design of each system component is described. Emphasis is placed on functional requirements unique in this system, including data bus communication, data bus transmitters and receivers, and ternary-to-binary torquing decision logic. Mechanization drawings are presented. Author

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N75-15731*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SERT 2 THRUSTER SPACE RESTART, 1974
William R. Kerslake and Robert C. Finke 1975 16 p refs Proposed for presentation at the Eleventh Elec. Propulsion Conf., New Orleans, 19-21 Mar. 1975; sponsored by AIAA
(NASA-TM-X-71651; E-8229) Avail: NTIS HC $3.25 CSCL 21H

The results of testing the flight thrusters on the SERT spacecraft during the 1974 test period are presented. The most notable result was the clearing of the high voltage short from thruster 2 and the successful stable operation of its ion beam. Test periods were limited to 70 minutes or less by earth eclipse of the spacecraft solar array and by ground station coverage limitations. Thruster 2 was restarted 26 times with an ion beam produced 21 times. The high voltage short remains in thruster 1, but the cathodes were restarted 12 times to demonstrate continued restart capability. The propellant feed systems, power processors, and spacecraft ancillary equipment were demonstrated to be functional after 4 1/2 years in space. In addition to the thruster tests, a neutralizer cathode was operated separately to

demonstrate that the potential level of a spacecraft could be controlled by the neutralizer alone. Author

N75-15732*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AUXILIARY PROPULSION THRUSTER PERFORMANCE WITH ION MACHINED ACCELERATOR GRIDS
Wayne R. Hudson 1975 20 p ref Proposed for presentation at 11th Elec. Propulsion Conf., New Orleans, 19-21 Mar. 1975; sponsored by AIAA
(NASA-TM-X-71653) Avail: NTIS HC $3.25 CSCL 21C

A substantial improvement in the performance of an 8-centimeter-diameter auxiliary propulsion thruster was achieved by reducing the diameter of the accelerator grid apertures. The accelerator grid hole geometry was defined by ion machining accelerator grids on an 8-centimeter thruster at thrust levels of 2.2, 4.4, and 6.7 millinewtons was (mN). A thruster with an ion machined accelerator grid was operated at a thrust of 4.4 mN for 1000 hours. The discharge propellant utilization was 92% at an eV/ion of 338. Thruster performance and accelerator grid hole geometry was documented as a function of thrust level. It was also determined that the small hole accelerator grid has a very low backstreaming voltage limit. In fact the thruster can be operated with the acclerator grid held at neutralizer tip potential. Author

N75-15733*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DIRECT THRUST MEASUREMENT OF A 30-cm ION THRUSTER
Bruce Banks, Vince Rawlin, Albert Weigand, and John Walker 1975 16 p refs Proposed for presentation at 11th Elec. Propulsion Conf., New Orleans, 19-21 Mar. 1975; sponsored by AIAA
(NASA-TM-X-71646; E-8215) Avail: NTIS HC $3.25 CSCL 21C

A direct thrust measurement of a 30-cm diameter ion thruster was accomplished by means of a laser interferometer thrust stand. The thruster was supported in a pendulum manner by three 3.65-m long wires. Electrical power was provided by means of 18 mercury filled pots. A movable 23-button planar probe rake was used to determine thrust loss due to ion beam divergence. Values of thrust, thrust loss due to ion beam divergence, and thrust loss due to multiple ionization were measured for ion beam currents ranging from 0.5 A to 2.5 A. Measured thrust values indicate an accuracy of approximately 1% and are in good agreement with thrust values calculated by indirect measurements. Author

N75-15734*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CONTROL LOGIC FOR A 30 cm DIAMETER ION THRUSTER
R. T. Bechtel 1975 19 p refs Presented at the 11th Elec. Propulsion Conf., New Orleans, 19-21 Mar. 1975; sponsored by AIAA
(NASA-TM-X-71647; E-8219) Avail: NTIS HC $3.25 CSCL 21C

The various missions to be performed by the 30-cm diameter mercury bombardment thruster engine are discussed. The operating constraints imposed by the thermal environment, allowable time to reach steady state operation, and the number of start-ups required are examined. The variety of requirements is further analyzed for the impact on the basic control logic for the engine. The control logic is divided into the start-up, run, and shutdown modes of operation. The start-up mode is reported. Author

N75-15735*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE EFFECTS OF EXPOSURE TO LN2 TEMPERATURES AND 2.5 SUNS SOLAR RADIATION ON 30-cm ION THRUSTER PERFORMANCE
Michael J. Mirtich 1975 14 p refs Presented at the 11th Elec. Propulsion Conf., New Orleans, 19-21 Mar. 1975; sponsored by AIAA
(NASA-TM-X-71652; E-8227) Avail: NTIS HC $3.25 CSCL 21C

An experimental test program was developed to demonstrate all 30 cm Hg-ion bombardment thruster functions over the thermal environment of several proposed missions. A 30 cm thruster with grids dished 1.25 cm and instrumented with 31 thermocouples, was placed in a vacuum tank equipped with minus 196 C walls. Cold storage of a thruster was simulated and temperatures as low as minus 100 C were attained on the thruster. The thruster started successfully from these cold conditions. The thruster operating at both half and full beam power was exposed to 2.5 suns on axis solar simulation. Various thruster thermal configurations, used to simulate multiple thruster operation, were tested at the above conditions. The results of these tests are reported herein. Author

N75-15736*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STUDIES OF INTERNAL SPUTTERING IN A 30-cm ION THRUSTER
M. A. Mantenenieks and V. K. Rawlin 1975 14 p refs Presented at the 11th Elec. Propulsion Conf., New Orleans, 19-21 Mar. 1975; sponsored by AIAA
(NASA-TM-X-71654; E-8232) Avail: NTIS HC $3.25 CSCL 21C

Initial studies have been made of the sputtering and deposition phenomena in a 30-cm thruster. Sputtering rates, of the cathode baffle, one of the main sources of sputtered material in a thruster, have been measured by weight loss as a function of several thruster parameters. Sputtering rates were found to increase with both cathode flow rate and beam current when constant discharge voltage of 37 volts and power loses of 185 ev/ion were maintained. Sputtering rates were reduced 24% as discharge voltage was decreased from 37 to 33 volts while keeping discharge power constant. Qualitative agreement was found between sputtering rates obtained by the weight loss and those implied by spectroscopically observed line intensities of the excited iron sputtered atoms. After the completion of the sputtering tests, deposition and sputtering sites inside the thruster were identified. Author

N75-15737*# Martin Marietta Corp., Denver, Colo.
FINITE ELEMENT ANALYSIS OF MERCURY SLOSH IN THE SOLAR ELECTRIC PROPULSION STAGE Final Report
J. N. Singh Jan. 1975 136 p refs
(Contract NAS8-29944)
(NASA-CR-120597; MCR-74-464) Avail: NTIS HC $5.75 CSCL 21C

The static equilibrium shapes of the neoprene bladder have been established corresponding to various ullage and gravity configurations under specified boundary conditions. The hemispherical bladder is taken to be attached at the diametral plane of the sphere with zero relative slope. With these shapes, the spherical tank with bladder and mercury has been modeled as an assemblage of finite elements. The properties of these elements have then been calculated using a linear displacement field. The dynamic characteristics were obtained to be used to define a mechanical analog which will reproduce the sloshing phenomenon of the system. Author

N75-15738*# Rocketdyne, Canoga Park, Calif.
HIGH PERFORMANCE N2O4/AMINE ELEMENTS: DATA DUMP COVERING. TASK 1: LITERATURE REVIEW
W. S. Hines and W. H. Nurick 23 Sep. 1974 55 p refs
(Contract NAS9-14126)
(NASA-CR-141566; R-9594) Avail: NTIS HC $4.25 CSCL 21B

The phenomenon of reactive stream separation (RSS) in the N2O4/amine earth-storable propellant combinations is reviewed. Early theoretical models of RSS are presented, as are experimental combustion data under simulated rocket conditions. N2O4/amine combustion chemistry data is also provided. More recent work in the development of a comprehensive model is described. N.E.R.

N75-15739*# Rocketdyne, Canoga Park, Calif.
SPACE SHUTTLE ORBIT MANEUVERING ENGINE REUSABLE THRUST CHAMBER. TASK 13: SUBSCALE HELIUM INGESTION AND TWO DIMENSIONAL HEATING TEST REPORT

R. D. Tobin 1974 46 p
(Contract NAS9-12802)
(NASA-CR-141560; ASR-74-329) Avail: NTIS HC $3.75 CSCL 21H

Descriptions are given of the test hardware, facility, procedures, and results of electrically heated tube, channel and panel tests conducted to determine effects of helium ingestion, two dimensional conduction, and plugged coolant channels on operating limits of convectively cooled chambers typical of space shuttle orbit maneuvering engine designs. Helium ingestion in froth form, was studied in tubular and rectangular single channel test sections. Plugged channel simulation was investigated in a three channel panel. Burn-out limits (transition of film boiling) were studied in both single channel and panel test sections to determine 2-D conduction effects as compared to tubular test results. Author

N75-15740*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A MULTIPLE THRUSTER ARRAY FOR 30-cm THRUSTERS
V. K. Rawlin and M. A. Matenieks 1975 13 p refs Proposed for presentation at 11th Elec. Propulsion Conf., New Orleans, 19-21 Mar. 1975; sponsored by AIAA
(NASA-TM-X-71657; E-8240) Avail: NTIS HC $3.25 CSCL 21C

A 3.0 m diameter chamber of the 7.6 m diameter by 21.4 m long vacuum tank was modified to permit testing of an array of up to six 30-cm thrusters with a variety of laboratory and thermal vacuum breadboard power systems. A primary objective of the Multiple Thruster Array (MTA) program is to assess the impact of multiple thruster operation on individual thruster and power processor requirements. The areas of thruster startup, steady-state operation, throttling, high voltage recycle, thrust vectoring, and shutdown are of special concern. The results of initial tests are reported. Author

N75-15741*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DYNAMIC CHARACTERISTIC OF A 30-cm MERCURY ION THRUSTER
John S. Serafini, Maris A. Mantenieks, and Vincent K. Rawlin 1975 20 p refs Proposed for presentation at the 11th Elec. Propulsion Conf., New Orleans, 19-21 Mar. 1975; sponsored by AIAA
(NASA-TM-X-71655; E-8234) Avail: NTIS HC $3.25 CSCL 21C

Measurements of the fluctuations of the discharge and beam plasmas of a 30 centimeter ion thruster were performed using 60 Hertz laboratory type power supplies. The time-varying properties of the discharge voltage and current, the ion beam current, and neutralizer keeper current were measured. The intensities of the fluctuations were found to depend on the beam and magnetic baffle currents. The shape of the frequency spectra of the discharge plasma fluctuations was found to be related to the beam and magnetic baffle currents. The measurements indicated that the discharge current fluctuations directly contribute to the beam current fluctuations and that the power supply characteristics modify these fluctuations. Author

N75-15742# Fairchild Space and Electronics Co., Germantown, Md.
SENSE 2: SPACE APPLICATIONS OF NUCLEAR POWER. VOLUME 1: COMMERCIAL COMMUNICATIONS SATELLITE
B. Raab May 1974 179 p
(Contract AT(49-15)-3063)
(AEC-SNS-3063-3-Vol-1) Avail: NTIS HC $7.00

The use of nuclear radioisotope power systems for commercial communications satellites and various military space missions, launched on present-day booster vehicles are studied. An evaluation is provided of competitiveness of radioisotope power systems as compared with solar power systems to provide power system designers with information on the important operating characteristics of the systems. Cm-244 and Pu-238 are considered as the radioisotope fuel. The organic Rankine system, Brayton system, and thermoelectric generators were considered as energy conversion systems. NSA

N75-15743# Stanford Univ., Calif. Dept. of Applied Mechanics.
THERMOMECHANICAL RESPONSE OF A VISCOELASTIC ROD SUBJECTED TO SINUSOIDAL DISPLACEMENTS
Richard W. Young Jul. 1974 37 p refs
(Contract N00014-67-A-0112-0060; NR Proj. 064-471)
(AD-787590; SUDAM-74-6) Avail: NTIS CSCL 21I

The forced vibrations of a rod of thermoviscoelastic material are studied. The rod is considered to be laterally insulated, but not constrained, such that a one-dimensional analysis may be carried out. Temperature dependence of the material properties and thermomechanical coupling effects are included. A steady state solution is found by means of finite difference formulations. A specific Lockheed solid propellant is studied and the presence of critical frequencies, characterized by locally high stresses and temperatures, is found for small amplitudes of vibration. The lack of a one-to-one correspondence between stress and displacement boundary conditions, due to the nonlinearities of the problem, is illustrated. No relationship between the critical frequencies of the driven rod and the natural frequencies of a rod with an equivalent temperature profile is found. (Modified author abstract) GRA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N75-15744# Ames Lab., Iowa.
COMPILATION OF EXPERIMENTAL WORK ON THERMAL EMITTANCES OF MATERIALS. PART 1: METALS
D. N. Baria and R. G. Bautista Apr. 1974 308 p refs
(Contract W-7405-eng-82)
(IS-3346-Pt-1) Avail: NTIS HC $9.25

A compilation of the experimental work on thermal emittances of metals reported in the literature through 1972 are presented along with a brief review of the various experimental methods available for thermal emittance determinations. An extensive bibliography of about 360 references is included. NSA

24 COMPOSITE MATERIALS

Includes laminates.

N75-15745 Polish Academy of Sciences, Warsaw.
METHODS OF INVESTIGATING THE FLOW PARAMETERS OF GRANULAR MATERIALS
Zenon Moroz, Andrzej Drescher, and Tomasz Hueckel 19 Dec. 1973 131 p refs In POLISH
(Rept-54/1973) Avail: Issuing Activity

A systematic treatment is presented of several basic methods for investigating the mechanical properties of crushed granular materials. Other topics discussed include the Coulomb-Mohr type of plasticity, triaxial compression, direct shear, plastic deformation, multiple shear, and anisotropy. Transl. by M.J.S.

N75-15746*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BEARING MATERIAL Patent Application
Harold E. Sliney, inventor (to NASA) Filed 10 Oct. 1974 27 p
(NASA-Case-LEW-11930-1; US-Patent-Appl-SN-513611) Avail: NTIS HC $3.75 CSCL 11D

A composite material is described which will provide low friction surfaces for materials in rolling or sliding contact and is self-lubricating and oxidation resistant up to and in excess of about 930 C. The composite is comprised of a metal component which lends strength and elasticity to the structure, a fluoride salt component which provides lubrication, and a glass component which not only provides oxidation protection to the metal but may also enhance the lubrication qualities of the composite. NASA

N75-15747# Advisory Group for Aerospace Research and Development, Paris (France).
TECHNICAL EVALUATION REPORT ON AGARD SPECIALISTS MEETING ON DIRECTIONALLY SOLIDIFIED IN-SITU COMPOSITES
E. R. Thompson (United Aircraft Corp., East Hartford, Conn.) Dec. 1974 9 p
(AGARD-AR-76) Avail: NTIS HC $3.25

Proceedings from this conference are reported as held to review the state of the art, identify gaps and difficulties in present knowledge and progress, and indicate approaches and goals for future efforts. The present state of developments of in-situ composites is evaluated, and several recommendations concerning directions of work considered necessary in this rapidly developing new field are presented. Increasing the temperature of turbine inlet gas in aircraft gas turbine engines promises to improve engine performance and economy. Directionally solidified eutectic alloys give indication of achieving high temperature strengths far exceeding those of the best current superalloys.
Author

N75-15748# Stanford Univ., Calif. Dept. of Applied Mechanics.
DISPERSION RELATIONS AND MODE SHAPES FOR WAVES IN LAMINATED VISCOELASTIC COMPOSITES BY FINITE DIFFERENCE METHODS Technical Interim Report
Subrata Mukherjee (Cornell Univ., Ithaca, N.Y.) and Erastus H. Lee Sep. 1974 34 p refs
(Contract N00014-67-A-0112-0081; NR Proj. 064-471)
(AD-787591; SUDAM-74-7) Avail: NTIS CSCL 11/4

Dispersion relations and mode shapes for wave propagation in a laminated, infinite viscoelastic composite are obtained by finite difference methods. A complex modulus formulation is used. Free vibrations are studied for which the frequency is complex and the wave number real. Floquet theory is applied. Discretization of the governing differential equations and quasi periodic boundary conditions leads to a generalized eigenvalue problem for a large, sparse complex matrix. This is solved by a method involving permutation of the matrix into a convenient banded form and by writing recursion relations for the determinant. As an example, numerical results are obtained for a two medium composite with the filament material elastic and the matrix material modelled as elastic in dilatation and a standard linear solid in shear. The method proves to be very efficient and accurate for calculating frequencies as well as mode shapes.
Author (GRA)

N75-15749# Pennsylvania State Univ., University Park. Materials Science Lab.
GLASSY CARBON ALLOYS Final Report
P. L. Walker, Jr. 15 Oct. 1974 71 p refs
(Contract DAHC15-71-C-0290)
(AD-787741) Avail: NTIS CSCL 11/2

Glassy carbons show promise of having a wide use in defense and space applications. The considerable porosity in glassy carbons results in their having a reasonably low coefficient of thermal expansion and, hence, reasonably good thermal shock resistance. This research program has had as one of its main objectives to determine the possibilities of ultimately modifying the structure and properties of glassy carbon by the addition of various elements to the starting organic precursors. Another main objective of this research program has been to study the effects of the application of pressure during polymerization and/or carbonization of glassy carbon precursors on the structure and properties of carbon produced. Progress and major results achieved in each area concern the following: Glassy Carbons as Modified by Addition of Metals; Glassy Carbons Produced by Processing Precursors Under High Pressure; Cellulose Carbon-Carbon fiber(Chemical Vapor Deposition) Composites; and Binary Glassy Carbons by Vapor Deposition Methods.
GRA

N75-15750# Duke Univ., Durham, N.C. Dept. of Civil Engineering.
SHAKEDOWN OF UNIDIRECTIONAL COMPOSITES
J. Q. Tarn, G. J. Dvorak, and M. S. M. Rao Apr. 1974 46 p refs
(Grant DA-ARO(D)-31-124-G103)
(AD-787430; Ser-10) Avail: NTIS CSCL 11/4

Substantial shakedown effects in unidirectional metal matrix composites have been found to exist for loading states which are axisymmetric with respect to the fiber axis, and which include also a uniform thermal change. The shakedown limits for a variable cyclic loading program, can be found by a standard procedure involving the selection of parametric families of selfstress states. An alternative, direct approach to the determination of the shakedown limits is related to the recently developed kinematic hardening rules for symmetrically loaded fibrous composites. Specifically, shakedown will occur if the loading domain can be contained within a translated initial yield surface in the axisymmetric stress plane. Results are presented for B-Al, Be-Al, B-Ti and B-Mg composites.
GRA

N75-15751# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
THREE-DIMENSIONAL FINITE-ELEMENT COMPUTER PROGRAM: USER'S GUIDE
Jon R. Dana and Richard M. Barker Aug. 1974 142 p refs
(Contract DAAF07-69-C-0444)
(AD-787422; VPI-E-74-19) Avail: NTIS CSCL 11/4

The FORTRAN Listing and User's Guide for a Three-Dimensional Linear Thermal-Elastic Finite-Element Computer Program is presented. The program will determine three-dimensional displacement and stress distributions for laminated orthotropic composite materials. A curved isoparametric element with 24 nodal points and 72 degrees-of-freedom is used to model the individual layers of a laminate. The nodal displacements are determined by minimizing the total potential energy of the system, at the element level, with a conjugate gradient iterative method. The program is presently (1974) running on an IBM 370/158 computer at Virginia Polytechnic Institute and State University.
Author (GRA)

N75-15752# Battelle Pacific Northwest Labs., Richland, Wash.
LAMELLAR COMPOSITES FORMED BY SPUTTER DEPOSITION Annual Technical Report, 1 May 1973 - 30 Apr. 1974
R. A. Busch and J. W. Patten Jul. 1974 58 p refs
(Contract F44620-73-C-0071; ARPA Order 2482)
(AD-787875; AFOSR-74-1595TR) Avail: NTIS CSCL 11/4

The objective of the program is to develop new composites which use the favorable properties of the materials they combine to produce properties which neither component originally has. Mechanical properties and their thermal stability are of primary interest for assessment of usefulness in engineering applications. Data and results from the first year's evaluation of two types of lamellar composites is presented and discussed.
GRA

N75-15753# Dartmouth Coll., Hanover, N.H. Thayer School of Engineering.
ELASTICITY SOLUTIONS FOR FIBER-REINFORCED, POLYMERIC COMPOSITE LAMINATES Final Report, 1 Feb. 1972 - 31 Jan. 1974
Richard D. Schile 31 Jan. 1974 178 p
(Contract F33615-72-C-1387; AF Proj. 7342)
(AD-787458; AFML-TR-74-116) Avail: NTIS CSCL 11/4

The objective of the program is the determination of the state of stress in laminated, rectangular plates in which the individual plies are composed of fiber-reinforced, polymeric material. The starting point for the analysis is the three-dimensional theory of elasticity. The continuity conditions between plies are taken into account by means of an integral formulation of three-dimensional stress function theory. When the number of laminations is very large, a correspondence principle has been derived which relates the stress state in the laminated plate to that in a corresponding, homogeneous, anisotropic plate. For unsymmetrically laminated plates, equations governing the coupled bending and stretching deformation were derived. (Modified author abstract)
GRA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N75-15754*# Technicolor Graphic Services, Inc., Houston, Tex.
WASH EFFICIENCY TESTS
Keith A. Maas Jul. 1972 30 p
(Contract NAS9-11500)
(NASA-CR-141496; TR-72-7) Avail: NTIS HC $3.75 CSCL 07B

Processed film products were tested for residual thiosulfate by precipitation as colored silver sulfide. The quantity of thiosulfate was determined and correlated with the expected storage life of the film. Author

N75-15755*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
POLYNOMIAL COEFFICIENTS OF THERMOCHEMICAL DATA FOR THE C-H-O-N SYSTEM
N. T. Wakelyn and Allen G. McLain Jan. 1975 30 p refs
(NASA-TM-X-72657) Avail: NTIS HC $3.75 CSCL 21B

Thermodynamic data are required input for the finite kinetics and equilibrium computer programs needed for modeling the combustion of hydrocarbons in the fields of energy and pollution research. Least squares determined coefficients of the curve-fitted thermodynamic data for 193 species in the C-H-O-N system are presented in card image form and are of suitable format for use by common computer programs. Author

N75-15756*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GROUND IDLE PERFORMANCE IMPROVEMENT OF A DOUBLE-ANNULAR COMBUSTOR BY USING SIMULATED VARIABLE COMBUSTOR GEOMETRY
Donald F. Schultz Washington Feb. 1975 32 p refs
(NASA-TM-X-3176; E-8097) Avail: NTIS HC $3.75 CSCL 21B

A test program was undertaken to determine if variable combustor geometry could be used to reduce exhaust emissions of a low-pressure-ratio jet engine operating at ground idle conditions. Three techniques for varying combustor geometry were simulated. Other techniques evaluated were radial fuel staging and the use of preheated fuel. When simulated variable combustor geometry was employed with radial fuel staging, combustion efficiency at a fuel-air ratio of 0.01 was increased from 77 to 95 percent, and exhaust emissions of unburned hydrocarbons and carbon monoxide were significantly reduced. Author

N75-15757# Technische Universitaet, Munich (West Germany).
STUDIES FOR DETERMINING ENERGY RESOLUTION PARAMETERS DURING GAMMA SPECTROSCOPY WITH CADMIUM SULFIDE AND CADMIUM TELLURIDE SINGLE CRYSTALS USING THE ISOLATOR METHOD Ph.D. Thesis [UNTERSUCHUNG DER DIE ENERGIEAUFLOESUNG BESTIMMENDEN PARAMETER BEI DER GAMMASPEKTROSKOPIE MIT CdS UND CdTe-EINKRISTALLEN MIT HILFE DER ISOLATORMETHODE]
Peter Eichinger 29 Jul. 1974 85 p In GERMAN
Avail: NTIS HC $4.75

The potential energy for producing an electron hole pair in cadmium sulfide and cadmium telluride is found by determining the primary free charge triggered by a gamma quantum through extrapolation of the overall charge as function of the charge field. Measurement results of 6.3 + or - 0.2 eV are about 1 eV less than earlier calculated data. Transl. by G.G.

N75-15758# Oak Ridge National Lab., Tenn.
CHEMICAL TECHNOLOGY DIVISION Annual Progress Report, period ending 31 Mar. 1974
Aug. 1974 103 p refs
(Contract W-7405-eng-26)
(ORNL-4966) Avail: NTIS HC $5.25

Research and development progress is reported in the following areas: (1) molten salt reactor program; (2) waste management; (3) transuranium element processing (4) preparation (U-233)02; (5) separations chemistry; (6) biochemical technology; (7) spectrophotometric studies of solutions with radioactive materials; (8) actinide oxides and carbides; (9) chemical engineering; (10) controlled thermonuclear program; (11) iodine sorption on charcoal; (12) chemical applications of nuclear explosions; and (13) thermal generation of hydrogen. A.L.

N75-15759# Brookhaven National Lab., Upton, N.Y.
THERMOLUMINESCENCE LiF TLD-100 DOSIMETER CRYSTALS
R. G. Fairchild, P. L. Mattern, K. Lengweiler, and P. W. Levy 1974 22 p refs Presented at Ann. Conf. on Nucl., and Space Radiation Effects, Fort Collins, Colo., 15 Jul. 1974
(BNL-18963; Conf-740707-11) Avail: NTIS HC $3.25

The unusually complex thermoluminescence obtained from Harshaw dosimeter type TLD-100 LiF crystals was studied with apparatus for measuring emission intensity simultaneously as a function of both wavelength and sample temperature. A separate signal averaged spectrum was obtained at 5.5 C temperature intervals. Data reduction include all correlations needed to obtain curves of absoulte intensity vs. photon energy. Numerous results were obtained from crystals exposed to Co-60 gamma-ray doses. All emission spectra could be resolved into Gaussian shaped bands using a computerized best-fit procedure. In the range usually used for dosimetry, at least the 3 bands at 3.0, 2.9, and 2.7 eV contributed to the thermoluminescence. Glow curves for each of the emission bands were constructed from the resolved Gaussian shaped bands. They contain 8, 3, and 5 prominent peaks. In contrast, glow curves for unresolved spectra contain at least 8 glow peaks, and each peak can contain undetermined contributions from 1, 2, or 3 emission centers. Author (NSA)

N75-15760# TRW Systems Group, Redondo Beach, Calif.
APPLICATION OF HOLOGRAPHIC METHODS TO THE MEASUREMENT OF FLAMES AND PARTICULATE, VOLUME 1 Final Report
A. B. White and D. E. Haflinger Apr. 1974 69 p refs
(Contract EPA-68-02-0603)
(PB-235674/9; TRW-23523-6001-TU-00-Vol-1; EPA-650/2-74-031-A-Vol-1) Avail: NTIS HC $4.25 CSCL 21B

A pulsed ruby laser holographic interferometer is applied to the study of flames, in hopes of extracting temperature profile data. The principle involved is to record holographically the interferogram which presents a three-dimensional record of the interference fringe pattern. The density profile and the temperature profile can be calculated from the fringe shift information. The report presents data for a methane-air burner operating both as a diffusion flame and as a premixed flame. The large number of fringe shifts recorded on an interferogram complicated the reduction of the methane-air data, but it was possible to correlate the interferometrically derived temperature data with thermocouple measurements. Application of the technique to a 0.2 gal/hr oil burner was unsuccessful because the highly turbulent flame caused an interference pattern that could not be deciphered. (Modified author abstract) GRA

N75-15761# Atlantic Research Corp., Alexandria, Va. Kinetics and Combustion Group.
A STUDY OF THE EFFECT OF FREE-RADICAL GENERATION BY FLOURINE AND FLUORINE PRODUCERS ON HYDROCARBON COMBUSTION Final Report, 1 Apr. 1969 - 30 Jun. 1974
30 Sep. 1974 62 p refs
(Contract N00014-69-C-0302; NR Proj. 092-535)
(AD-787516; TR-PL-10432) Avail: NTIS CSCL 21/2

It is proposed to adapt hydrocarbon fuels to the ignition requirements of supersonic combustion by injecting small quantities of fluorine or active fluorine compounds into the air stream. Ignition limits and ignition lags of mixtures of fluorine, oxygen and inert gas with propane and butane have been determined experimentally and the chemical - kinetic theory of these systems has been substantially resolved. Methane has been included in this work in a different frame of experimentation and theoretical analysis, corresponding to the fact that the various

free-radical reactions associated with the break-up of the higher hydrocarbon molecules do not occur with methane. Some data on ignition of mixtures of fluorine, oxygen and hydrocarbons including methane, butane and cyclohexadiene have been interpreted. Several previously unknown elementary reactions have been identified, including a reaction of alkyl peroxide radicals with oxygen that appears to play a cardinal role in the so-called cool flame regime of the reaction of oxygen with higher hydrocarbons. The effect of small concentrations of free radicals on the ignition process is illustrated by the example of propane-air ignition in the temperature field of a reflected shock wave and a combustion wave. The fluorine effect is further demonstrated by an investigation of the effect of fluorine on the ignition temperature in methane-air combustion waves, and the mechanism of ignition or explosion of mixtures of fluorine, oxygen and higher hydrocarbons is studied. GRA

N75-15762# University of Southern Calif., Los Angeles. Dept. of Physics.

VACUUM ULTRAVIOLET EMISSION AND ABSORPTION PROPERTIES OF GASES AND HOT PLASMAS Final Report, 16 Jun. 1964 - 30 Jun. 1974

Masaru Ogawa and G. L. Weissler 15 Sep. 1974 21 p

(Contract N00014-67-A-0269-0014)

(AD-787461; USC-VACUV-150; ARPA Order 125-62) Avail: NTIS CSCL 07/4

The report briefly summarizes research on the interaction of vacuum ultraviolet (VUV) with matter, including absorption and emission by gases and hot plasmas and atmospheric chemistry applications. Publications and personnel are listed. GRA

N75-15763# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

COMBUSTOR PERFORMANCE PARAMETERS FOR HYDROCARBON FUELS

F. S. Billig, P. J. Waltrup, and L. A. Dale May 1974 61 p refs

(Contract N00017-72-C-4401)

(AD-787510; APL-TG-1246) Avail: NTIS CSCL 21/2

A survey of fuel producers and jet engine developers was made to determine the hydrogen carbon atom ratios and heats of formation of JP type fuels currently being used to estimate engine performance. On the basis of these results, standardized values were selected for JP-5, THMCPD (RJ-4), and Shelldyne H (RJ-5) for use in thermochemical computations. Calculations were made for the combustion of these fuels in a defined clean air and in air preheated by the combustion of either hydrogen or propane with makeup oxygen (vitiation heating). Following combustion, each of the product mixtures was expanded isentropically, and conditions at the sonic point were defined. On the basis of these results, simple correlating equations describing the important gas dynamic relationships were derived. With these expressions, it is possible to deduce combustor performance from a variety of experimental measurements without resorting to the complex thermochemical calculational procedures. (Modified author abstract) GRA

N75-15764# Pratt and Whitney Aircraft, West Palm Beach, Fla. Research and Development Center.

INVESTIGATION OF CENTRIFUGAL FORCE AND REYNOLDS NUMBER EFFECTS ON COMBUSTION PROCESSES Interim Report, Jun. 1973 - Jan. 1974

George D. Lewis and Clifford E. Smith Aug. 1974 54 p refs

(Contract F44620-73-C-0061; AF Proj. 6813)

(AD-787865; PWA-FR-6551; AFOSR-74-1598TR) Avail: NTIS CSCL 21/2

During the period between 30 June 1973 and 30 June 1974, tests in a combustion centrifuge have demonstrated that increased buoyancy produced by centrifugal force can be used to increase flamespeeds significantly over turbulent flamespeed, which controls combustion rates in conventional burners. A preliminary model has been developed that predicts the flame-spreading rate at various burner conditions. Comparison with experimental data obtained from a scale model afterburner operating on the buoyant flamespreading principle confirms the model predictions. In addition, a second model, based on classical heat transfer correlations, has been developed to predict with reasonable accuracy the extinction limits of flames at very high centrifugal force values. The effects of Reynolds number on turbulent flamespeeds of propane-air and hydrogen-air mixtures have also been measured. Author (GRA)

N75-15765# Naval Weapons Center, China Lake, Calif.

SPECTRAL TRANSMITTANCE OF SINGLE CRYSTAL AMMONIUM PERCHLORATE AND DEUTERATED AMMONIUM PERCHLORATE

Marian E. Hills and William R. McBride Aug. 1974 13 p refs

(Proj. R000-01)

(AD-787504; NWC-TP-5683) Avail: NTIS CSCL 07/4

Ammonium perchlorate is widely used as an oxidizer in solid propellants. Little information about its spectral transmittance, is available. Such information would be helpful, for example, in estimating the effectiveness of radiation of a given wavelength in heating a crystal for decomposition. The spectral transmittance of large single crystals of ammonium perchlorate and deuterated ammonium perchlorate grown from aqueous solution has been measured in the ultraviolet, visible, near infrared, and infrared regions of the spectrum. The absorption edge of both the deuterated and undeuterated crystals lies in the ultraviolet regions near 200 nanometers. There are strong absorption bands in the near infrared and infrared regions. (Modified author abstract) GRA

N75-15766# Rosenstiel School of Marine and Atmospheric Sciences, Miami, Fla.

SEAWATER AS A MULTICOMPONENT ELECTROLYTE SOLUTION

Frank J. Millero 1974 79 p refs Repr. from the Sea, v. 5, Marine Chemistry

(Contracts Nonr-4008(02); NSF GA-17386)

(AD-787490; Contrib-1650) Avail: NTIS CSCL 07/4

The authors review some of the new concepts of multicomponent electrolyte solutions and show how they can be applied to seawater. It is hoped that the application of these methods to the medium of seawater will provide a new approach to understanding the physical chemistry of seawater. Although the ion pairing models have proven to be very useful in discussing the interactions in seawater, it is not necessary to use this model to examine the physical chemistry of seawater. By using some of the new models for multicomponent electrolyte interaction, it is possible to estimate and treat the ionic interactions in seawater without invoking the concept of ion-pairing (even though ion pairing may occur). The authors attempt to answer such fundamental questions as: Can the physical chemical properties of seawater be treated as a simple electrolyte (e.g., sea salt). What are the properties of this sea salt. How do the properties of sea salt depend on the major components of seawater. GRA

N75-15767# British Steel Corp., Sheffield (England). Information Services.

THE ANALYSIS OF OXIDE MATERIALS OVER A WIDE RANGE OF COMPOSITION USING A DILUTION TECHNIQUE

A. A. Tunney and H. Hughes Aug. 1974 20 p refs

(PB-236356/2; GS/TECH/300/2/74/C) Avail: NTIS HC $3.25 CSCL 07D

In order to extend the field of application of X-ray fluorescence to the analysis of oxide materials a method based on using lanthanum oxide as a heavy absorber to minimize interference effects was investigated. Calibration graphs are illustrated for fifteen constituents of interest. The advantages and limitations of the technique are discussed. A correction method based on alpha-factors has advantages but problems in developing such a method are referred to briefly. (Modified author abstract) GRA

N75-15768# Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.

A PROCESS FOR CLEANING AND REMOVAL OF SULFUR COMPOUNDS FROM LOW Btu GASES Interim Report, Oct. 1972 - Aug. 1974

R. H. Moore, C. H. Allen, G. F. Schiefelbein, and R. F. Maness Aug. 1974 93 p refs

(Contract DI-14-32-0001-1519)

(PB-236522/9; BNW-211B01284; OCR-100-Int-1) Avail:

NTIS HC $4.75 CSCL 07A

Production of low Btu fuel gas for use in gas turbines imposes stringent requirements on a gas cleaning process to prevent corrosion and erosion of turbine blades. The gas must be cleaned at high temperatures to achieve maximum efficiency. A venturi scrubber is described which utilizes a molten salt as the working fluid to clean the gas. The venture utilizes kinetic energy in the gas to disperse the molten salt in the gas phase. Laboratory studies demonstrated process feasibility and a pilot plant was constructed to accept 50-100 SCFM of fuel gas from a fixed bed gasifier. Gasifier and pilot plant gas scrubbing equipment are in shakedown operation. GRA

N75-15769# National Research Development Corp., London (England).
PRESSURISED FLUIDIZED BED COMBUSTION Monthly Progress Report, Aug. 1972 - Sep. 1973
Wayne A. McCurdy Oct. 1974 230 p
(Contract DI-14-32-0001-1511)
(PB-236498/2) Avail: NTIS HC $7.50 CSCL 21B

The effect of operating at bed temperatures of up to 1750 F are investigated. Factors considered are: (1) freedom from deposits and erosion of a static cascade of turbine blades; (2) sulfur and NOx emissions; and (3) the sintering behavior of the material in the bed. The commercial incentives to operate at higher bed temperatures and turbine inlet temperatures are to further increase the efficiency of power generation and the simplication of operation over a wide load range. The results of the investigations and related translation to commercial operating conditions have reinforced the claims as to the bendfits that will accrue from using pressurized fluidized combustion. GRA

N75-15770# Southwest Research Inst., San Antonio, Tex.
COLLABORATIVE STUDY OF METHOD FOR STACK GAS ANALYSIS AND DETERMINATION OF MOISTURE FRACTION WITH USE OF METHOD 5 Environmental Monitoring Series
Henry F. Hamil and Richard E. Thomas Jun. 1974 40 p refs
(Contract EPA-68-02-0626)
(PB-236929/6; EPA-650/4-73-026) Avail: NTIS HC $3.75 CSCL 14B

Statistical analyses are performed on data from EPA method 3 and from the stack gas moisture fraction determination obtained in the collaborative testing of EPA method 5 (particulates). For method 3, the precision of CO2 and O2 determination using an Orsat analyzer is investigated, as well as the effect of this on the dry molecular weight and excess air calculations. The effect of variability in CO2 and O2 determinations on correcting particulate determinations to a common base is studied. The precision of the determination of the moisture fraction of the stack gas by the formula in method 5 is studied. Recommendations are made for the improvement of the precision of the Orsat method. GRA

N75-15771# Spectrogram Corp., North Haven, Conn.
DISCRIMINATION OF WASTE OILS BY MICRO EMISSION SPECTROCHEMICAL ANALYSIS: PHASE 1 Final Report
John D. Johnson and Herbert R. Gram Jun. 1974 56 p refs
(Contract DOT-CG-33185)
(AD-787717; Rept-0236; USCG-D-21-75) Avail: NTIS CSCL 07/4

The discrimination of waste oil from unused oil products, when recovered from the surface of navigable waters, is made by the determination of the metallic content of the oil. A micro emission spectrochemical technique is developed, together with a low power pulsed high frequency spark discharge source. Tests are conducted on samples exposed to laboratory extractions of sea water and river water. Tests are also conducted on samples naturally weathered on the surface of brackish tidal water from an estuary. Iron, lead, copper and silicon are selected as the key elements, which identify an oil as a waste. A conceptual design of a compact, portable direct reading instrument, based on this study, is included to complete the initial phase of this work. Author (GRA)

N75-15772# National Research Development Corp., London (England).
PRESSURIZED FLUIDIZED BED COMBUSTION Interim Report, Aug. 1972 - Sep. 1973
Jul. 1974 198 p
(Contract DI-14-32-001-1511)
(PB-235591/5; OCR-85-INT-1) Avail: NTIS MF $2.25; SOD HC $2.20 CSCL 21B

Research on pressurized fluidized bed combustion for clean electric power generation from coal is reported. The capabilities are assessed of pressurized fluidized combustion while minimizing atmospheric pollution, avoiding excessive maintenance problems and reducing capital and operating costs of electric power generating systems. In particular, the study examines the effect on fouling of turbine blades, emission of alkalis and oxides of sulfur and nitrogen, and the bed behavior when operating at 1650 to 1750 F. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N75-15773*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE EFFECT OF MICROSTRUCTURE ON THE FRACTURE TOUGHNESS OF TITANIUM ALLOYS Annual Report, 25 Sep. 1973 - 30 Nov. 1974
R. H. VanStone, J. R. Low, Jr., and J. L. Shannon, Jr. Dec. 1974 106 p refs Prepared by Carnegie-Mellon Univ.
(Grant NGR-39-087-047)
(NASA-TM-X-72356; TR-2-Ti) Avail: NTIS HC $5.25 CSCL 11F

The microstructure of the alpha titanium alloy Ti-5Al-2.5Sn and the metastable beta titanium alloy Beta 3 was examined. The material was from normal and extra low interstitial grade plates which were either air-cooled or furnace-cooled from an annealing treatment. Beta 3 was studied in alpha-aged and omega-aged plates which were heat treated to similar strength levels. Tensile and plane strain fracture toughness tests were conducted at room temperature on the alpha-aged material. The microstructure and fracture mechanisms of alloys were studied using optical metallography, electron microscopy, microprobe analyses, and texture pole figures. Future experiments are described. Author

N75-15774*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECT OF SERVICE USAGE ON TENSILE, FATIGUE, AND FRACTURE PROPERTIES OF 7075-T6 AND 7178-T6 ALUMINUM ALLOYS
Richard A. Everett, Jr. Washington Feb. 1975 27 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Hampton, Va.
(NASA-TM-X-3165; L-9952) Avail: NTIS HC $3.75 CSCL 11F

A study has been made to determine the effects of extensive service usage on some basic material properties of 7075-T6 and 7178-T6 aluminum alloy materials. The effects of service usage were determined by comparing material properties for new material (generally obtained from the literature) with those for material cut from the center wing box of a C-130B transport airplane with 6385 flight-hours of service. The properties investigated were notched and unnotched fatigue strengths, fatigue-crack-growth rate, fracture toughness, and tensile properties. For the properties investigated and the parameter ranges considered (crack length, stress ratio, etc.), the results obtained showed no significant difference between service and new materials. Author

N75-15775# Oak Ridge National Lab., Tenn.
EFFECT OF NITROGEN CONCENTRATION ON SHORT- AND LONG-TERM BEHAVIOR OF UNSTABILIZED AUSTENITIC 18/14 CrNi STEEL
Manfred Schirra [1974] 28 p refs Transl. into ENGLISH of Report KFK-Ext-6/73-5 from Kernforschungszentrum (Karlsruhe), 10 Sep. 1973 Sponsored by AEC
(ORNL-tr-2835; KFK-Ext-6/73-5) Avail: NTIS HC $3.75

The effect of the nitrogen concentration in two melts

containing 0.04% and 0.14% N on the short- and long-term creep-strength behavior of an unstabilized 18/14 CrNi steels at temperatures up to 800 C was studied experimentally. Raising the nitrogen concentration from 0.04% to 0.14% slightly increases the elastic limit and the tensile strength, decreases the elongation at fracture, but did not significantly affect the proportional elongation. The creep strength values are also improved, but an unequivocal effect on the values of the ductility in the creep experiment was not detectable. The experimental results are compared with data in the literature on the effect of nitrogen concentration in steels with 15-18% Cr, 6-20% Ni, 0-10% Mn and 0-2% Mo. Author (NSA)

N75-15776# Royal Aircraft Establishment, Farnborough (England).
BETA PHASE TITANIUM ALLOYS: THE MAIN FEATURES OF THE HEAT TREATMENTS OF BETA 3 (Ti-11.5Mo-6Zr-4.5Sn
R. Molinier, L. Seraphin, R. Tricot, and R. Castro Nov. 1974 27 p refs Transl. into ENGLISH from Rev. Met. (Paris), v. 71, no. 1, 1974 p 63-74
(RAE-Lib-Trans-1807; BR44648) Avail: NTIS HC $3.75

The heat treatments of quench, and quench and age (both single and double age) are interpreted using the isothermal transformation diagram for the beta 3 alloy. The diagram consists essentially of two distinct regions, the beta + alpha, and the beta + omega region. The structure and morphology of the phases present are described, and the quench characteristics of the alloy given. The tensile properties of different products show that a strength exceeding 120 hbar can regularly be obtained after adequate ageing. New softening treatments are proposed to overcome the difficulties of using the classical techniques of de-scaling in salt baths. These are full annealing, and isothermal quenching, which, in contrast to over-ageing treatments, give stable metallurgical conditions. Author

N75-15777# Aeronautical Research Labs., Melbourne (Australia).
A NEW MODEL FOR INITIATION AND GROWTH OF FATIGUE CRACKS
S. P. Lynch May 1974 48 p refs
(ARL/Met-94) Avail: NTIS HC $3.75

Fatigue-crack initiation, involving the extrusion/intrusion process, and crack growth processes are considered. The results, based mainly on observations of fatigue in an age-hardened Al-Zn-Mg alloy, are applicable to fatigue in a wide variety of materials. The deformation of model specimens consisting of soft layers hundreds of micrometers thick, sandwiched between harder regions, successfully simulated many of the features of the fatigue process and demonstrated that extrusions were produced when soft layers were squeezed out at the surface. The deformation of soft layers is discussed in terms of macroplasticity theory (slip-line-field theory) and microplasticity (dislocation theory). It was found that the formation of a fine subgrain structure within the soft layers during fatigue permits extensive deformation in these layers. The formation of striations on fatigue fracture surfaces (and on extrusion surfaces) is discussed. An analysis of crack growth by intrusion of soft layers predicts that the crack-growth increment per cycle should depend on the crack-tip-opening displacement and the dimensions of the soft layer ahead of the crack. Author

N75-15778# Technische Universitaet, Munich (West Germany).
FRACTURE PROBABILITY OF POLYCRYSTALLINE ALUMINUM OXIDE UNDER CONSIDERATION OF VOLUME, SURFACE, AND LOAD-EFFECTS Ph.D. Thesis [BRUCHWAHRSCHEINLICHKEIT VON POLYKRISTALLINEM ALUMINIUMOXID UNTER BERUECKSICHTIGUNG VON VOLUMEM-, OBERFLAECHEN-, UND BELASTUNGSEINFLUESSEN]
Horst R. Maier 1 Aug. 1974 183 p refs In GERMAN
Avail: NTIS HC $7.00

The volume-surface-load model in connection with the Weybull theory and material parameter considerations are used to predict the fracture behavior of prismatic polycrystalline aluminum oxide rods under static stress and four point bending loads at 800 C. Separation of the various parameters establishes the dominant effects of volume on fracture resistance. Transl. by G.G.

N75-15779# Junta de Energia Nuclear, Sacavem (Portugal). Lab. de Fisica e Engenharia Nucleares.
EFFECT OF THE STRUCTURE OF ZIRCALOY-2 ON ITS MECHANICAL PROPERTIES
A. P. Loureiro 1973 48 p refs In PORTUGUESE; ENGLISH abstract
(LFEN-151(A)) Avail: AEC Depository Libraries HC $5.50

The correlation between structural features (including texture, nature and size of the grains, and degree of cold forming) and the mechanical properties exhibited by Zircaloy-2 was studied. A survey is made on the structures in products made of Zircaloy-2, followed by an account of the corresponding mechanical properties. The later are determined through tests carried out prior to subjecting the material to the corrosion and radiation conditions prevailing in reactors. Emphasis is placed on the most advisable treatments to obtain the adequate structures for each application. Author (NSA)

N75-15780# Du Pont de Nemours (E. I.) and Co., Aiken, S.C.
EFFECT OF HYDROGEN ON METALS
M. R. Louthan, Jr. 1974 23 p refs Presented at the Process Industries Corrosion Short Course Meeting, St. Louis, 9-13 Sep. 1974
(Contract AT(07-2)-1)
(DP-MS-73-68; Conf-740923-1) Avail: NTIS HC $3.25

Hydrogen embrittlement of metals is separated into three categories: embrittlement resulting from blister formation, embrittlement from hydride formation, and generalized hydrogen embrittlement. The causes and mechanisms are discussed, and guides to select materials to resist this phenomenon are included. Author (NSA)

N75-15781# California Univ., Berkeley. Lawrence Berkeley Lab. Inorganic Materials Research Div.
CRYOGENIC PROPERTIES OF Fe-Mn AND Fe-Mn-Cr ALLOYS
M. J. Schanfein, M. J. Yokota, V. F. Zackay, E. R. Parker, and J. W. Morris, Jr. May 1974 28 p refs Presented at Symp. on Properties of Mater. for Liquid Nat. Gas Tankage, Boston, 21 May 1974
(Contract W-7405-eng-48)
(LBL-2764; Conf-740549-1) Avail: NTIS HC $3.75

A wide range of microstructures were obtained in Fe-Mn alloys by varying the manganese and chromium contents. When a bcc (alpha) structure was produced, increasing amounts of manganese were found to be detrimental to low temperature toughness. At manganese levels greater than 12% where appreciable amounts of epsilon and gamma phases formed the ductile-brittle transition temperature dropped rapidly. In terms of the (epsilon + gamma) phases present, the ductile-brittle transition temperature decreased at a rate of 1.3 C/vol % (epsilon + gamma). Increasing the (epsilon + gamma) content to achieve good low temperature toughness, however, also caused a decrease in the yield strength. Increases in the yield strength were achieved without appreciable increase in the ductile-brittle transition temperature by greater manganese additions and by chromium additions. Author (NSA)

N75-15782# Los Alamos Scientific Lab., N.Mex.
LIQUID PHASE SINTERING OF W-Ni-Fe
E. G. Zukas and L. S. Levinson Jul. 1974 13 p refs
(Contract W-7405-eng-36)
(LA-5665-MS) Avail: NTIS HC $3.25

During the liquid-phase sintering of W-Ni-Fe composites, solid tungsten single crystal spheroids are surrounded by a molten matrix of W-Ni-Fe. These spheroids grow in a regulated manner if the sintering time or the sintering temperature is raised. A low matrix volume composite sintered in a temperature gradient showed anomalous behavior. The spheroid size did not decrease with decreasing temperature, and the average spheroid size was larger than expected. Composites of higher matrix volume had a smaller average spheroid size at the lower temperatures. Copper was injected into presintered and liquid-phase sintered composites to follow matrix flow. The copper concentration decreased with distance from the hot zone for high volume matrix alloys, but in the low volume matrix alloys the copper was distributed uniformly throughout the matrix. The anomalous behavior is attributed to a mechanism dependent on capillary action. The decreased pore

radius between the spheroids in the low matrix volume composites increases the capillary forces by 25%. Author (NSA)

N75-15783# Brown Univ., Providence, R.I. Div. of Engineering.
COMBINED MACROSCOPIC AND MICROSCOPIC APPROACH TO THE FRACTURE OF METALS Technical Progress Report, Jul. 1973 - Jun. 1974
J. Gurland and J. R. Rice Jul. 1974 13 p refs
(Contract AT(11-1)-3084)
(COO-3084-29) Avail: NTIS HC $3.25

The problem of interpreting the macroscopic toughness parameters in terms of the deformation and fracture processes at a macroscopic crack is being actively pursued in two directions: (1) a recently developed incremental finite-element program for problems of arbitrarily large plastic-elastic deformations has been applied successfully to the first of a series of accurate analyses of large deformation processes in the crack tip region, and (2) studies of the microscale mechanisms of cleavage initiated rupture at the crack tip in irradiated pressure vessel steel and in spheroidized carbon steels continue to justify the previously stated fracture propagation criteria, namely that a critical local stress level must be achieved in front of the crack and that this level must prevail over a significant microstructural size scale. A study was initiated on diffusive mechanisms of crack growth along grain boundaries at elevated temperatures, with interesting results indicating that the crack growth is limited not by the time-limiting factor in rupture but by the critical stress conditions at the crack tip as affected by the time-dependent overall deformation. Author (NSA)

N75-15784# Sandia Labs., Livermore, Calif.
EXAMINATION OF SEVERAL HIP, P-1 BERYLLIUM MODIFICATIONS
B. C. Odegard Aug. 1974 23 p refs
(Contract AT(29-1)-789)
(SAND-74-8207) Avail: NTIS HC $3.25

Modifications to the standard CIP/HIP, P-1 beryllium have been made to produce high ductility and high strength grade materials. The modifications included powder input size, HIP temperature, oxide content, and silicon content. Using optical and electron microscopy, microstructures produced by these modifications were examined to provide an insight into observed mechanical property differences. Results show the mechanical properties were dependent on the grain size as indicated by the Hall-Petch correlation. The grain size was dictated by the powder input size. Other microstructural features are described.
Author (NSA)

N75-15785# California Univ., Livermore. Lawrence Livermore Lab.
HELIUM RELEASE FROM VARIOUS METALS
J. R. Cost and R. G. Hickman 22 Jul. 1974 20 p refs Presented at the 21st Natl. Symp. of the Am. Vacuum Soc., Anaheim, Calif. 19 Oct. 1974 Sponsored by AEC Submitted for publication
(UCRL-75739; Conf-741015-1) Avail: NTIS HC $3.25

The metals Al, Fe, Ni, and types 304 and 316 stainless steel were doped with He by allowing dissolved tritium to undergo radioactive decay. He concentrations below 1 atomic ppM were produced. Using high sensitivity, mass spectrometer techniques, He release was observed during isochronal and isothermal anneals. At least two release mechanisms are obvious, their respective gas releases occurring at widely separated temperatures. Author (NSA)

N75-15786# California Univ., Berkeley. Lawrence Berkeley Lab.
MICROSTRUCTURAL FEATURES AFFECTING FRACTURE TOUGHNESS OF HIGH STRENGTH STEELS
E. R. Parker and V. F. Zackay Jun. 1974 17 p refs Presented at the Intern. US-Japan Conf. on Fracture Mech., Sendai, Japan, 12 Aug. 1974
(Contract W-7405-eng-48)
(LBL-2771; Conf-740824-1) Avail: NTIS HC $3.25

The fracture toughness of quenched and tempered steels, such as AISI 4340, AISI 4130, and 300M, can be increased by 50 to 100 percent by minor changes in heat treating procedures. Certain microstructural features, particularly blocky ferrite, upper bainite, and twinned martensite plates, are deleterious to fracture toughness. Similarly, the presence of undissolved carbides and sulfide inclusions, which act as crack nuclei, can lower fracture toughness by 25 to 50 percent. Other microstructural constituents, such as lower bainite, autotempered martensite, and retained austenite can enhance fracture toughness. By controlling the amounts and distributions of the microstructural constituents, the fracture toughness values of AISI 4340, AISI 4130, and 300M can be raised to the fracture toughness level of 18Ni maraging steel at equivalent values of yield strength.
Author (NSA)

N75-15787# Central Electricity Generating Board, Berkeley (England). Research Dept.
METALLOGRAPHIC EXAMINATION OF STEEL FRICTION SPECIMENS RUBBED IN HELIUM-BASED ATMOSPHERES
A. A. Parry and J. E. Palmer Apr. 1974 11 p
(RD/B/N-3024) Avail: AEC Depository Libraries HC $4.00

Four steels were rubbed on themselves in helium alone and in helium and carbon dioxide at up to 500 C. They were a mild steel, an austenitic stainless steel, a nitrided steel, and a tool steel. Surface and subsurface effects revealed by metallography are discussed. The mild and stainless steels showed damage extending to about 40 microns below the rubbed surface, and considerable thickness of transferred and work hardened material. The much harder nitrided and tool steels showed almost no subsurface damage, and very minor amounts of metal transfer. The structural and oxidation implications of surface cracks and damage are discussed briefly. Author (NSA)

N75-15788# Atomics International, Canoga Park, Calif.
VOID FORMATION IN A COLD-WORKED TYPE 316 STAINLESS STEEL IRRADIATED WITH 1-MeV PROTONS
D. W. Keefer and A. G. Pard 28 Jun. 1974 29 p refs
(Contract AT(04-3)-824)
(AI-AEC-13129) Avail: NTIS HC $3.75

Cold-worked Type 316 stainless steel was irradiated at 500 and 600 C with 1-MeV protons. The dependence of void formation on displacement damage, irradiation temperature, and microstructure was studied by transmission electron microscopy. Cold working delays the onset of swelling and reduces it, via a reduction in void size, at both irradiation temperatures. Inhomogeneity in the cold-worked microstructure leads to inhomogeneity in the disposition of voids. Swelling at 600 C is greater than at 500 C; the voids are less numerous, but larger, at the higher temperature. No change in the cold-worked microstructure can be detected by transmission electron microscopy after 500 C irradiation to 23 displacements per atom (dpa). Irradiation to a comparable damage level at 600 C results in almost complete elimination of the cold-worked microstructure. Comparison is made with reactor irradiation experiments. Author (NSA)

N75-15789# Birmingham Univ. (England). Dept. of Physical Metallurgy and Science of Materials.
THERMODYNAMICS OF ALLOYS: STUDIES OF NICKEL-GALLIUM, NICKEL-GERMANIUM AND NICKEL-RHODIUM ALLOYS Final Technical Report, Apr. 1973 - May 1974
J. N. Pratt, J. M. Bird, and S. Martosudirdjo May 1974 39 p refs
(Contract DAJA37-73-C-3010; DA Proj. 200-61102-B-32D)
(AD-786609) Avail: NTIS CSCL 11/6

Tin solution calorimetry has been used to measure the heats of formation of the solid phases of the nickel-gallium system at 300K and of the nickel-germanium system at 330K. Values are reported for the two nickel-rich binary solid solutions and for the intermediate phases Ni3Ga, Ni2Ga, Ni3Ga2, NiGa, Ni3Ga7, Ni2Ga3, Ni3Ge, Ni2Ge and NiGe. These and previously determined heats of formation of related palladium alloy compounds are compared and factors affecting the bonding mechanisms are discussed; a dependence of inter-component transfer upon electron concentration and electronegativity differences is suggested by a re-examination of the more extensive data available. Free energies of formation of the complete range of Ni-Rh solid solutions were obtained. These are combined with heats of formation, provided by tin solution calorimetry, to

complete the thermodynamic assessment of the system. (Modified author abstract) GRA

N75-15790# Northeastern Univ., Boston, Mass.
STUDY OF METASTABLE ALLOY PHASES BY DIFFRACTION TECHNIQUES BASED ON HIGH-RESOLUTION ENERGY COUNTERS Final Report
Bill C. Gleasen 30 Aug. 1974 14 p refs
(Grants DA-ARO(D)-31-124-G1127; DA-ARO(D)-31-124-71-G1)
(AD-787521; AROD-8292-9-MC) Avail: NTIS CSCL 11/6

This report summarizes the results obtained in a study of metastable alloys produced by ultra-rapid quenching from the melt (splat cooling). The crystal structures of new metastable phases were determined by X-ray powder diffractometry; the energy dispersive diffraction technique originally intended for use in this work was evaluated and improved but found to be less powerful for the present purpose than angular dispersive diffractometry. Results in six main areas are listed: (1) B-metal alloys, including the Sn-Tl, Hg-In, Hg-Tl and Pb-Sn systems and Ga phases with In and Sn; (2) Ge alloy phases with Fe, especially a vacancy-stabilized CsCl type Ge-Fe phase connecting with six-coordinated metastable Ge(Fe); (3) A review of the splat cooling process; (4) Structures of the equilibrium phases AuPb3, Cr5Si3Cx, and 5 ternary M phases; (5) Use of energy dispersive counters for X-ray diffraction work; (6) Structures of metastable alloys at high pressures. (Modified author abstract) GRA

N75-15791# California Univ., Los Angeles. School of Engineering and Applied Science.
ACOUSTIC EMISSION AND MICROSCOPIC DEFORMATION AND FRACTURE PROCESSES
Kanji Ono Aug. 1974 68 p refs
(Contract N00014-69-A-0200-4031)
(AD-787086; UCLA-ENG-7465) Avail: NTIS CSCL 11/6

This paper reviews diverse observations of acoustic emission from materials and attempt to interpret them on the basis of current knowledge of plastic deformation and fracture. Observed acoustic emission characteristics have been classified into five categories, which arises from heterogeneous and homogeneous yielding, dynamic strain aging, twinning and other heterogeneous deformation and strain induced transformation of acoustic emission during plastic deformation are examined in relation to these metallurgical aspects as well as the mechahical vibration viewpoint. For example, tensile deformation of magnesium is mainly via twinning, which generates shear mode acoustic emission. On the other hand, the yielding of a HSLA steel sample excites longitudinal resonances along the length of the sample. It is shown that the micro-yielding concept with suitable modifications best explains these acoustic emission behavior observed. This paper also reviews important aspects of measurement techniques and theoretical considerations of acoustic emission behavior. GRA

N75-15792# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
INFLUENCE OF YIELD STRENGTH ON OVERLOAD AFFECTED FATIGUE CRACK GROWTH BEHAVIOR IN 4340 STEEL Final Report, Feb. 1973 - Feb. 1974
J. P. Gallagher and T. F. Hughes Jul. 1974 53 p refs
(AF Proj. 1467)
(AD-787655; AFFDL-TR-74-27) Avail: NTIS CSCL 11/6

Single tensile overloads were applied to 4340 steel specimens which were treated to give 120 and 220 ksi yield strength levels. The influence of yield strength level on the number of nonsteady state crack growth cycles subsequent to the application of a 100 percent overload was noted to be substantial. The number of nonsteady state cycles for the 120 ksi strength steel was approximately an order of magnitude greater than that of the higher strength steel. A retardation model was developed using a residual stress intensity factor concept similar to that proposed by Willenborg et al. The model was found to predict to within 10 percent the number of nonsteady state crack growth cycles required to move a crack from the pre-overload position to a subsequent position, one overload induced plane stress plastic zone radius ahead of the pre-overload position. The model indicates that the reason for substantial increase in nonsteady state crack growth cycles observed for the low strength steel is due to a corresponding increase in the overload affected zone size. Author (GRA)

N75-15793# National Environmental Research Center, Cincinnati, Ohio. Solid and Hazardous Waste Research Lab.
ALUMINUM AS A COMPONENT OF SOLID WASTE AND A RECOVERABLE RESOURCE Final Report
Ronald J. Talley and Richard H. Ongerth Sep. 1974 39 p refs
(PE Proj. 1DA312)
(PB-235770/5; EPA-670/5-74-005) Avail: NTIS HC $3.75 CSCL 11F

This report surveys the production and use of aluminum and its occurrence in solid waste; the aspects related to resource recovery are emphasized. Surveyed are both the primary and secondary aluminum industries, which produce aluminum from virgin materials (i.e., bauxite) and scrap, respectively. Supply and demand analysis is used to analyze fluctuations in scrap prices and implications of increased recovery of aluminum from solid waste. GRA

N75-15794# Naval Research Lab., Washington, D.C.
OBSERVATIONS ON USE OF THE J INTEGRAL TO DETERMINE PLANE-STRAIN FRACTURE TOUGHNESS FROM SUBSIZED SPECIMENS OF A TITANIUM 6Al-4V ALLOY Final Report
G. R. Yoder and C. A. Griffis 3 Sep. 1974 21 p refs
(RR02246)
(AD-787634; NRL-7789) Avail: NTIS CSCL 11/6

J-integral procedures were used to obtain resistance curves of J versus crack extension from fatigue-precracked specimens of a titanium 6Al-4V alloy. Specimens of various geometries were employed, all in three-point bending. Crack extensions were delineated by heat tinting. The value of the J integral at the initiation of crack extension, J sub Ic, was determined from the resistance curves and compared with a valid K sub Ic value for this material. Comparison was made of the results obtained with the approximation equation J = 2A/Bb to those obtained with the more cumbersome compliance technique in which the analytical plane-stress solutions of Bucci et al. were used. The range of ratios of crack length to specimen width was examined over which J = 2A/Bb holds, as was the decrease in crack extension at the experimental limit load with increase in ratio of specimen thickness to uncracked ligament. Variation in J sub Ic from specimens cut from different positions through the plate thickness was also explored. Author (GRA)

N75-15795# Little (Arthur D.), Inc., Cambridge, Mass.
INVESTIGATION OF THE POSSIBILITIES FOR ELECTROCHEMICAL CONTROL OF HOT CORROSION MECHANISMS Final Report, Dec. 1972 - Dec. 1973
Joan B. Berkowitz anp W. David Lee Apr. 1974 60 p refs
(Contract N62269-73-C-0288)
(AD-787055; ADL-75526-FR) Avail: NTIS CSCL 11/6

The effect of applied currents on the hot corrosion of nickel, pure Nichrome, Inconel 600, Hastelloy X, and a Co-Cr-Al-Y alloy in both sodium sulfate melts and a sodium sulfate seeded flame has been briefly investigated. In the molten salt bath, some evidence of anodic protection was observed with strip samples of the chromia forming alloys, Nichrome and Inconel 600. Polished spherical samples of Inconel 600 were not corroded by the molten salt until structural defects were introduced either by abrading the surface or by application of high anodic or cathodic currents. In the salt seeded flame, the rate of corrosion was affected very little by applied currents, probably because of the low current densities achievable in a flame system. Evidence was obtained for a difference in mechanism between anodically and cathodically polarized Nichrome samples, oxidation being more pronounced at the cathode and sulfidation at the anode. (Modified author abstract) GRA

N75-15796# Aluminum Co. of America, Alcoa Center, Pa. Physical Metallurgy Div.
TEST AND EXPLORATORY DEVELOPMENT OF AN OPTIMUM ALUMINUM ALLOYS SYSTEM FOR SHIP STRUCTURES Final Technical Report, 23 Jun. 1972 - 23 Jul. 1974
Ralph W. Rogers, Jr., William D. Vernam, and M. Byron Shumaker

23 Jul. 1974 78 p refs
(Contract N00024-72-C-5571; SF5410011)
(AD-787568; Rept-56-AC223) Avail: NTIS CSCL 11/6

Evaluation of plate fabricated in the laboratory from a series of Al-Mg alloys having magnesium contents of 7.0 to 9.5% showed an alloy designated as CS19 met the contract requirement of an as-welded yield strength of 30 ksi minimum. Fracture toughness and resistance to general corrosion, to exfoliation and to initiation of stress-corrosion cracks were at least equivalent to present 5456-H116 or H117 alloys. MIG weldments of CS19 plate produced with CS19 electrode and by a practice which provides interpass cooling to 250F were highly resistant to stress-corrosion cracking even after thermal treatment at 212F to simulate metallurgical changes taking place during long periods of service. Nominal composition of CS19 is Al-8.25 Mg-0.4 Mn-0.1 Cr with 0.12 max. Fe and 0.10 max. Si. (Modified author abstract) GRA

N75-15797# Watervliet Arsenal, N.Y.
SURVEY AND CRITICAL REVIEW OF DYNAMIC MECHANICAL PROPERTIES OF METALS
D. P. Kendall Jul. 1974 60 p refs
(DA Proj. 1J5-62604-A-607)
(AD-787274; WVT-TR-74034) Avail: NTIS CSCL 11/6

The general technical literature from all known sources that contains mechanical property data on metals at strain rates in the range of 0.01 to .0001/sec is reviewed. The general trends of the data are discussed for each metal and alloy class. Results on the same material from different sources are compared and consensus results given where possible. The effects of elevated and low temperatures are discussed. Information is also presented in the form of charts which show the range of strain rate and temperature for which data are available for each metal and alloy class. Author (GRA)

N75-15798# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON ANOMALOUS CHANGES IN THE GRAIN BOUNDARY ENERGY OF NICKEL MICRO-ALLOYED TO LANTHANUM OR CERIUM
A. D. Koval and V. E. OLshanetskii 17 Sep. 1974 16 p refs
Transl. into ENGLISH from Metallo Fiz. (USSR), no. 44, 1973 p 67-72
(FTD Proj. F74-01-10)
(AD-787348; FTD-HC-23-1714-74) Avail: NTIS CSCL 11/6

Experimental data and calculations are presented which show that introducing small quantities of lanthanum or cerium into nickel leads to segregation at the grain boundaries. On complete filling of the boundaries with lanthanum atoms, the subsequent formation of chemical compounds leads to a decrease in the grain boundary energy. M.J.S.

N75-15799# Massachusetts Inst. of Tech., Cambridge. Materials Processing Lab.
WEAR PARTICLE FORMATION MECHANISMS Annual Report, Sep. 1973 - May 1974
Harry Koba and Nathan H. Cook May 1974 98 p
(Contract N00014-67-A-0204-0054; NR Proj. 229-003)
(AD-787838) Avail: NTIS CSCL 11/6

A lightly loaded, room temperature, lubricated bronze on steel sliding system was studied to determine the mechanisms of wear debris formation. Examination of the sliding surfaces was carried out with both optical and scanning electron microscopes. The lubricating oil was processed through a Ferrograph Analyzer to remove the wear particles so that they could be examined. It was found that both the bronze and steel surfaces were capable of a high degree of strain during sliding contact. The high surface strain caused by repeated surface contact during sliding allowed for the nucleation and progressive propagation of surface and sub-surface cracks, to produce wear particles. Cross-sections showed cracks nucleating at voids which had become elongated due to a sub-surface strain gradient. Material transferred from one surface to another appeared to aid in the surface smoothening process. Large pieces (20 micrometers and over) were found to be made up of many smaller wear particles which became compacted due to sliding contact. (Modified author abstract) GRA

N75-15800# British Steel Corp., Sheffield (England). Information Services.
AN ASSESSMENT OF THE STROHLEIN MONOMAT 300 OXYGEN ANALYZER
J. Davey and J. C. Carr Aug. 1974 8 p
(PB-236354/7; GS/EX/42/74/C) Avail: NTIS HC $3.25 CSCL 11F

A prototype model of the new Strohlein Monomat 300 Oxygen Analyzer was critically assessed. Short and long term reproducibilities were determined. Regular recalibration was found necessary to obtain the best results. GRA

N75-15801# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.
PHASES AND INTERDIFFUSION BETWEEN TITANIUM AND ITS MONONITRIDE
F. W. Wood, P. A. Romans, R. A. McCune, and O. G. Paasche Sep. 1974 46 p refs
(PB-237029/4; BM-RI-7943) Avail: NTIS HC $3.75 CSCL 11F

The Ti-TiN system was studied by observing the phases formed by diffusion reactions between titanium and titanium nitride at nominal temperatures of 800C, 950C, 1,200C, 1,500C. Metallographic specimens were examined optically, with an electron microprobe, with an electron microscope, and by X-ray diffraction. A new phase diagram is proposed and tentative diffusion coefficients are obtained for nitrogen in alpha- and epsilon-phase materials. A better understanding of the nitride phases of titanium is important to prevent, eliminate, or minimize nitride inclusions in titanium alloy ingots. GRA

N75-15802# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.
SOURCE AND CONTROL OF NITRIDE INCLUSIONS IN TITANIUM Technical Report, 1971 - 1973
Jack L. Henry, S. D. Hill, W. E. Anable, and J. L. Schaller Sep. 1974 55 p refs
(PB-237034/4; BuMines-RI-7933) Avail: NTIS HC $4.25 CSCL 11F

The Bureau of Mines investigated possible sources of nitride defects in the production of magnesium-reduced titanium sponge in order to determine if such defects are capable of surviving consumable electrode arc melting. The production of alpha-stabilized nitride inclusions in hot-rolled titanium plate from air contamination of sponge during its manufacture was experimentally demonstrated. The highest incidence of inclusions in hot-rolled plate resulted from sponge which was reduced by air-contaminated magnesium and subjected to air contamination during the vacuum distillation cycle and during helium sweep. Maintainance of good vacuum-tight integrity, filtration of molten magnesium prior to charging into the reduction retort, and mechanical attrition of sponge to pulverize and disperse nitrides are suggested as practices to lower inclusion incidence in commercial titanium ingots. (Modified author abstract) GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N75-15803*# Carborundum Co., Niagara Falls, N.Y. Research and Development Div.
DEVELOPMENT OF A THERMAL ACOUSTICAL AIRCRAFT INSULATION MATERIAL Final Technical Report
Ruey Y. Lin and Edward A. Struzik Nov. 1974 48 p
(Contract NAS9-13641)
(NASA-CR-141498) Avail: NTIS HC $3.75 CSCL 11G

A process was developed for fabricating a light weight foam suitable for thermal and acoustical insulation in aircraft. The procedures and apparatus are discussed, and the foam specimens are characterized by numerous tests and measurements. N.E.R.

N75-15804# Royal Aircraft Establishment, Farnborough (England).
STABLE POLYPHENOXYLS. 2: POLYMERISATION

BEHAVIOUR OF MONOMERS WITH A STERICALLY HINDERED FREE OR SHIELDED PHENOLIC HYDROXYL GROUP

D. Braun and B. Meier Nov. 1974 26 p refs Transl. into ENGLISH from Makromol. Chem. (Basel), v. 175, 1974 p 791-810

(RAE-Lib-Trans-1809; BR44611) Avail: NTIS HC $3.75

The 2,6 Di(tert-butyl)-4-vinylphenol (Ia), 2,6-di (tert-butyl)-4-isopropenylphenol (Ib) and 2,6-di(tert-butyl)-4-isopropenylanisol (1c) can be polymerized only by a cationic mechanism with proton or Lewis acids. Free radical or anionic polymerization is impossible. In the cationic copolymerization with styrene, (1a) and (1b) were preferentially incorporated in the copolymers. (1a) and (1b) gave crosslinked homo- or copolymers if during the propagation step sec-carbonium ions were formed. The homopolymerization of (1c) or (1b) gave polymers which were soluble in benzene. The crosslinking is caused by a chain transfer reaction of growing sec-macrocarbonium ions with hydroxylic groups of other polymer chains. Author

N75-15805# California Univ., Livermore. Lawrence Livermore Lab.

ABSTRACTS OF ADHESIVE COLLOQUIUM AT LLL

L. E. Peck 20 May 1974 21 p Conf. held at Livermore, Calif., 24-25 Apr. 1974

(Contract W-7405-eng-48)

(UCID-16509; Conf-740442) Avail: NTIS HC $3.25

An informal presentation of adhesive data has been made by the various AEC subcontractors on a yearly basis. Historically these meetings are an outgrowth of the inter-agency materials meetings. The meeting included fifteen papers dealing with all aspects of adhesive problems. A copy of the agenda and abstracts of some of the papers are included. Author (NSA)

N75-15806# Bendix Corp., Kansas City, Mo.

LIGHT LOAD FRICTION COEFFICIENT AND WEAR STUDY OF THREE BONDED SOLID LUBRICANTS Technological Spinoff Report

D. P. Pope Aug. 1974 19 p

(Contract AT(29-1)-613)

(BDX-613-1170) Avail: NTIS HC $3.25

Light load coefficient and wear life data were compiled for Electrofilm 77S, 4396, and 4396S bonded dry film lubricants. Static and dynamic friction performance was studied using a tribometer specially designed to test bonded films. Mean and standard deviations were calculated for comparison. Electrofilm 77S, the data indicated, was better for light load applications. Author (NSA)

N75-15807# Bendix Corp., Kansas City, Mo.

EFFECTS OF THERMAL EXPANSION ON EPOXY GLASS LAMINATES Technological Spinoff Report

E. E. Combs Aug. 1974 40 p

(Contract AT(29-1)-613)

(BDX-613-1171) Avail: NTIS HC $3.75

A study was made of the effects of thermal expansion on epoxy glass laminates used to manufacture solder dipped and leveled printed wiring boards. Gradual or instant shock encountered during the process cycle was found to have no adverse effects on circuit board quality during normal manufacturing and rework. Author (NSA)

N75-15808# Naval Ship Research and Development Center, Annapolis, Md.

DEVELOPMENT OF MATERIALS RESISTANT TO WEAR AND CORROSION FOR MECHANICAL-FACE-SEAL APPLICATIONS Research and Development Report

D. C. Vreeland, B. E. Miller, and J. Carroll Nov. 1974 18 p refs

(AD-787642; NSRDC-4299) Avail: NTIS CSCL 11/1

Two new compositions of hard-facing alloys and one cermet were developed as corrosion- and wear-resistant materials for mechanical-face-seal applications. After showing excellent resistance to localized corrosion, in a newly developed laboratory test, the hard-facing alloys were fabricated in the form of weld rods by a casting process and in the form of powders by an atomization process. The weld rods were used with the gas tungsten-arc process to make successful weld deposits on Inconel 625 coupons. The powders were applied by a plasma weld-surfacing technique to Inconel 625. A special cermet was developed for possible use as a mechanical-face-seal wearing surface. The cermet showed excellent properties in wear tests and in laboratory and sea-water corrosion tests. (Modified author abstract) GRA

N75-15809# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

LUBRICATION-SPACE EXPERIENCE AND DESIGN CRITERIA

R. A. Mattey Jun. 1974 57 p refs

(Contract N00017-72-C-4401)

(AD-787511; APL-TG-1245) Avail: NTIS CSCL 11/8

Before a solid film lubricant warrants consideration for use on bearings and gears of space mechanisms, information relating to wear life and past applications is needed. This report presents a summary of information collected on the use of two solid film lubricants and a sputtered film of MoS2 on a number of space mechanisms. One film (inorganic) is composed of MoS2, graphite, gold, and sodium silicate and is referred to as MLF-5. The other film (Organic) is MoS2, Sb2O3, and PI-4701 polyimide resin and is referred to as MLR-2. The application and use of the lubrication methods are outlines, wear life data are given, and a number of items where the films were used are discussed. GRA

N75-15810# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.

HIGH TEMPERATURE SLOW CRACK GROWTH IN CERAMIC MATERIALS Interim Report, 1 Sep. 1973 - 31 Jan. 1974

A. G. Evans Feb. 1974 49 p refs

(Contract F33615-73-M-6501; AF Proj. 3130)

(AD-787743; NBSIR-74-442) Avail: NTIS CSCL 11/2

High temperature slow crack growth processes in several ceramic materials are examined under static and cyclic loading conditions. Data obtained at temperatures up to 1400C are used for purposes of failure prediction and for analysis of the slow crack growth phenomena. It is shown that purity plays a major role in slow crack growth resistance, particularly in the hot pressed materials, and that cycling in the low frequency regime does not significantly increase the rate of slow crack growth. The slow crack growth mechanisms appear to be primarily plasticity related. Two semi-quantitative mechanisms are presented, one due to dislocation motion and the other due to grain boundary sliding. Author (GRA)

N75-15811# Air Force Materials Lab., Wright-Patterson AFB, Ohio.

A RHEOLOGICAL STUDY OF CERAMIC SUSPENSIONS AT VERY LOW SHEARING STRESSES Technical Report, Aug. 1969 - Dec. 1971

James C. Sikra, Gerard W. Phelps, and Harold T. Smyth Mar. 1974 172 p refs

(AF Proj. 7350)

(AD-787457; AFML-TR-73-220) Avail: NTIS CSCL 11/2

The rheological behavior of aqueous suspensions of ceramic materials was investigated at very low shearing stresses. A sensitive coaxial cylinder viscometer of original design was used. A sanitaryware slip was studied in this investigation. Flow behavior was studied at various stages during the coagulation process and again after the slip was fully gelled. The results of this study revealed that coagulation occurred even in slips carried to the lowest point on their deflocculation curve. With regard to low-shear slip rheology, this study indicated that the flow of the gelled suspensions at low stresses was viscoelastic in nature. Several flow regions were found to exist. At extremely low stresses, no measureable response was observed. At somewhat higher stresses, purely elastic behavior was noted for the under-deflocculated slips. At still higher stresses, in addition to elasticity, a region of creep was observed which was Newtonian up to stress levels at which breakdown occurred. Above these stress levels, the gel network was destroyed and accelerated flow began. Author (GRA)

N75-15812# Army Materials and Mechanics Research Center, Watertown, Mass.

SILICON NITRIDE: A PROMISING MATERIAL FOR RADOME APPLICATIONS Final Report
Donald R. Messier and Philip Wong Sep. 1974 9 p refs
(DA Proj. 1T1-62105-A-330)
(AD-787255; AMMRC-TR-74-21) Avail: NTIS CSCL 09/5

Dielectric properties of various reaction-sintered and hot-pressed silicon nitride specimens were measured at 10 GHz at room temperature, 1000F and 2000F. Dielectric constant values ranged from 5.5 to 9.3, and loss tangent values from 0.001 to 0.16. The major detrimental impurity was identified as residual unreacted silicon. Author (GRA)

N75-15813# Gulf General Atomic, San Diego, Calif.
MICROSTRUCTURAL OBSERVATIONS ON A COMMERCIAL GLASSY CARBON
J. L. Kaae Aug. 1974 10 p refs
(Contract DAHC15-71-C-0282)
(AD-787680; GA-A13121) Avail: NTIS CSCL 11/2

Ion sputtering has been used to thin a commercial glassy carbon for transmission electron microscopy. This thinning technique produces much larger thin regions than fragmentation which has previously been employed to produce specimens of glassy carbon for transmission electron microscopy and allows examination of the microstructure on a much broader scale. The glassy carbons which were examined were heat treated to 1800C. Specimens from several different lots were first thinned by mechanical polishing to a thickness of about 0.001 in. and then were further thinned by bombardment with 6 KeV argon ions until perforation. Examination of the thin regions was carried out in a Phillips EM300 transmission electron microscope at an accelerating voltage of 100 KV. Only at high magnifications could structure be resolved in the major portions of the foils. Ribbons spheroids and inclusions are described. GRA

N75-15814# Ceradyne, Inc., Chatsworth, Calif.
HOT PRESSED BERYLLIA Final Technical Report, Jun. 1972 - Jan. 1973
Jack A. Rubin and Weclon J. Gardner 29 Oct. 1973 25 p
(Contract N00014-72-C-0421)
(AD-787847) Avail: NTIS CSCL 11/2

This program showed that to produce a hot pressed beryllium oxide (BeO) ceramic tube for use in a high intensity infrared lamp is a more difficult and complex than originally believed. The lack of uniformity and reproducibility of commercially available BeO powder, which will hot press to the degree of transparency necessary to produce a useful tube, is one of the severest problems encountered. GRA

N75-15815# California Univ., Berkeley. Dept. of Chemical Engineering.
DYNAMIC MECHANICAL AND DIELECTRIC RELAXATIONS IN BLENDS OF HOMOPOLYMERS AND BLOCK COPOLYMERS
U. Mehra, L. Toy, K. Biliyar, and M. Shen 1 Jul. 1974 25 p refs Sponsored in part by ARPA
(Contract N00014-69-A-0200-1053; NR Proj. 356-526)
(AD-787134; TR-11) Avail: NTIS CSCL 11/9

The relaxation behavior of two series of blends of homopolymers with block copolymers were investigated. The first series are blends of poly(ethylene-co-vinyl acetate) with poly (styrene-b-ethylene-co-butylene-b-styrene). The second series are poly (ethylene oxide) blended with poly(ethylene oxide-b-propylene oxide-b-ethylene oxide). Samples were prepared by casting from appropriate solvents. Dynamic mechanical and dielectric measurements were carried out between -150C and 100C. For both series, the loss peaks observed were attributable to molecular motions of the homopolymer segments. No intermediate transitions, such as those observed previously in polyblends of polybutadiene with poly(styrene-b-butadiene-b-styrene), can be seen in these two systems. Author (GRA)

N75-15816# Naval Air Development Center, Warminster, Pa. Crew Systems Dept.
EVALUATION OF NOMEX, AND POLYPROPYLENE BLEND-TYPE COLD WEATHER UNDERWEAR Final Report
Craig Jencks 25 Mar. 1974 29 p refs
(AD-787638; NADC-74068-40) Avail: NTIS CSCL 15/5

A Nomex and a Polypropylene Blend-Type Cold Weather Underwear have been operationally evaluated in conjunction with the CWU-33/P Anti-Exposure Ventilated Wet Suit for the purpose of determining whether either garment provides better overall performance characteristics than the standard fleet-issued aviation polyvinylchloride underwear. A replacement for the polyvinvychloride underwear is sought because of the underwear's unsatisfactory shrinkage with high temperature shipboard laundering. Concluding evaluation analysis indicates that both evaluated underwear types are nearly identical to each other in all respects with both being preferred over the standard polyvinylchloride underwear. The Nomex underwear has been selected for Fleet introduction over the Polypropylene blend-type underwear, based on its greater fire resistant properties and logistic availability. (Modified author abstract) GRA

N75-15817# Army Foreign Science and Technology Center, Charlottesville, Va.
PHASE DIAGRAMS OF SILICATE SYSTEMS: HANDBOOK. THIRD ISSUE: TERNARY SYSTEMS
N. A. Toropov, V. P. Barzakovskii, V. V. Lapin, N. N. Kubtseva, and A. I. Baikova 10 Jun. 1974 652 p refs Transl. into ENGLISH from unidentified Russian Journal, Leningrad, 1972, 448 p
(AD-787517; FSTC-HT-23-750-74) Avail: NTIS CSCL 07/4

In the third issue of the handbook Phase Diagrams of Silicate Systems, information is included on the phase relationships in systems containing silica and two other oxides (for example, Al_2O_3, B_2O_3, MgO, CaO, BaO, Na_2O, K_2O, Ln_2O_3, GeO_2, TiO_2, ZrO_2, P_2O_5, Cr_2O_3, MnO, FeO, Fe_2O_3, H_2O, fluorides, sulfides and others). The systems examined are the physicochemical basis for production of refractories, various types of ceramics, glass, materials for radioelectronics, nuclear engineering, etc. Not only are equilibrium phase diagrams presented in the handbook, but the phases existing in the subsolidus region, as well as under high pressure conditions, are described. Some physical constants are given (optical properties, structural characteristics, etc.) of the major compounds existing in the corresponding systems. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N75-15818# Stevens Inst. of Tech., Hoboken, N.J. Dept. of Mechanical Engineering.
HYDROGEN AS A FUEL Semiannual Technical Report, 1 Jan. - 30 Jun. 1974
R. F. McAlevy, III, R. B. Cole, J. W. Hollenberg, L. Kurylko, and R. S. Magee 31 Aug. 1974 238 p refs
(Contract N00014-67-A-0202-0046; ARPA Order 2615)
(AD-787484; ME-RT-74011) Avail: NTIS CSCL 21/4

An engineering study of the technical problems expected with the large-scale introduction of hydrogen (H_2) as a fuel has been initiated. Information was gathered and evaluated regarding H_2 generation, transportation and utilization as an engine fuel. H_2 generation by coal gasification, electrolysis and thermochemical processes using nuclear heat sources was investigated. Although embrittlement by H_2 might weaken the pipeline itself, the principal problem expected in this mode of transmission appears to lie with existing compressors. A novel regenerative, compressor is discussed in this regard. Fundamental relationships between fuel properties and reciprocating engine performance parameters are established and form a rational basis for evaluating H_2 (vs. gasoline) as a fuel. An extensive review of published results revealed that H_2 was capable of highly efficient, low polluting operation of such engines when fuel-lean mixtures were used. (Modified author abstract) GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N75-15819# Sandia Labs., Albuquerque, N.Mex.
EXTENSION OF CONTROL TECHNIQUES FOR DIGITAL CONTROL OF RANDOM VIBRATION TESTS
J. D. Tebbs and D. O. Smallwood 1974 25 p Presented at the 45th Shock and Vibration Symp., Dayton, Ohio, 22 Oct. 1974 Submitted for publication Sponsored by AEC
(SAND-74-5049; Conf-741006-2) Avail: NTIS HC $3.25

The basic control algorithm for digitally controlled random vibration tests can be expanded to include more complex test requirements than the single control channel test. Three control techniques (averaging, random-on-random, and response limiting) that were implemented and tested show the flexibility of digital control to adapt to new testing requirements without hardware reconfigurations. NSA

N75-15820# Sandia Labs., Albuquerque, N.Mex.
DESIGN AND OPERATING CHARACTERISTICS OF A BALLOON-BORNE VACUUM SYSTEM
R. O. Woods [1974] 15 p Presented at the 8th APCRL Sci. Balloon Symp., Hyannis, Mass., 30 Sep. 1974 Sponsored by AEC
(SAND-74-5275; Conf-740914-2) Avail: NTIS HC $3.25

A vacuum pump that was specifically intended for use in balloon experiments at altitudes approaching 50 kilometers is described. In addition to light weight, the system was designed for a prolonged liquid nitrogen holding time and an unusually high intermittent pumping speed. It differed in several important respects from pumps of the conventional laboratory configuration. Author (NSA)

N75-15821# California Univ., Livermore. Lawrence Livermore Lab.
LIMIT OF ACCURACY OF MACHINE TOOLS
J. B. Bryan and E. G. Loewen 23 Apr. 1974 13 p refs Presented at Intern. Conf. on Production Eng., Tokyo, 26 Aug. 1974 Sponsored by AEC
(UCRL-75645; Conf-740825-1) Avail: NTIS HC $3.25

Accuracy of a machine tool is determined by the following factors: (1) attitude of the user, (2) production volume, (3) workpiece material, and (4) the specific accuracy parameter required such as roundness or size. It is shown that the accuracy of machine tools continues to advance since there are no technological barriers of a universal nature and that the necessary incentives are provided by the benefits arising from improved accuracy, such as longer life of product, advancement in basic science, and improved interchangeability. Author (NSA)

N75-15822# Stanford Research Inst., Menlo Park, Calif.
AN OVERVIEW OF THE SIGNIFICANT RESULTS TO DATE FROM THE SYSTEMS ANALYSIS OF THE AMPHIBIOUS ASSUALT LANDING CRAFT PROGRAM
A. R. Grant, J. I. Steinman, and P. S. Jones 1 Jul. 1974 49 p
(Contract N00014-71-C-0390; NR Proj. 264-008)
(AD-787585) Avail: NTIS CSCL 13/10

The report presents an optimization of amphibious operations relative to size, quantity, landing craft configuration, effectiveness, and overall costs. GRA

N75-15823# National Bureau of Standards, Boulder, Colo. Inst. for Basic Standards.
ELECTROCALORIC REFRIGERATION FOR SUPERCONDUCTORS Semiannual Technical Report
30 Jun. 1974 49 p refs
(ARPA Order 2535)
(AD-787660) Avail: NTIS CSCL 13/1

The goal of the program is to demonstrate the feasibility of a refrigerator based on the electrocaloric effect. It is planned to develop a prototype refrigerator which will absorb on the order of 1 watt at 4 K and have an upper reservoir temperature of 15 K. Applied research has been carried out mainly in two areas, (1) the glass-ceramic dielectric materials to be used as the refrigeration element and (2) heat switches to allow the cyclic refrigeration unit to be operated in a continuous manner. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N75-15824 Nauka Press, Moscow (USSR).
INCREASING THE ACCURACY OF TRANSMISSION OF DIGITAL INFORMATION ON DISCRETE CHANNELS
E. L. Blokh, ed. 1974 241 p refs In RUSSIAN
Copyright. Avail: Issuing Activity

Formation and decoding of correction codes with feedback are discussed. Mathematical models of discrete channels were constructed and applied to the analysis of digital information transmission systems. For individual titles, see N75-15825 through N75-15853.

N75-15825 Nauka Press, Moscow (USSR).
POTENTIAL AND REALIZED CORRECTING CHARACTERISTICS OF CASCADING CODES ON THE BASIS OF REED-SOLOMON CODES
E. L. Blokh and V. V. Zyablov *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 5-17 refs In RUSSIAN (For availability see N75-15824 07-32)
Copyright.

A method is described in which Reed-Solomon codes are used as second degree codes whose combinations are subject to random linear transformation before coding by first degree codes. Two cases of first degree coding were investigated. It is shown that: for both cases of coding with first degree codes, the overwhelming part of the cascade codes have optimal potential correcting characteristics (code spacing and error detection probability); and if one first degree code is used, an improvement in the characteristics takes place without the deterioration which occurs during algebraic cascade coding. Transl. by M.J.S.

N75-15826 Nauka Press, Moscow (USSR).
THE OPTIMALITY OF ONE CLASS OF FRAGMENT-CYCLIC CODES
I. I. Grushko *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 18-20 refs In RUSSIAN (For availability see N75-15824 07-32)
Copyright.

A binary situation is described in terms of a quasi-cyclic code, if the cycle shift of a given code word leads to that word. The generated matrix in the linear case is presented by using the appropriate permutation of lines and columns. It is found that the codes of this class emerge on the Varshamov-Hilbert boundary. Transl. by M.J.S.

N75-15827 Nauka Press, Moscow (USSR).
SOME CHARACTERISTICS OF CONVOLUTIONAL CODES WITH 1/2 SPEED
T. L. Maystrova *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 21-26 refs In RUSSIAN (For availability see N75-15824 07-32)
Copyright.

A method is proposed for describing binary convolution codes. The binary sequences are recorded by groups of coordinate numbers corresponding to nonzero sequential values, and above the number groups, operations are determined for convolution and position. It is found that this method allows the isolation of a code class with 1/2 speed which does not have the largest minimal code spacing. Transl. by M.J.S.

N75-15828 Nauka Press, Moscow (USSR).
CORRECTION OF GROUPED ERRORS BY A CASCADE LOCALIZATION METHOD
O. V. Popov *In its* Increasing the Accuracy of Transmission of

Digital Inform. on Discrete Channels 1974 p 27-42 refs In RUSSIAN (For availability see N75-15824 07-32)
Copyright.

The construction and decoding were investigated of block linear codes for correcting grouped errors with their preliminary localization in one or several stages. It is found that the results allow the formation of multistage codes with less excess, and quarantee the correction of a complex class of errors. Particular attention is paid to constructing codes for channels in which errors can emerge with different degree of grouping.
Transl. by M.J.S.

N75-15829 Nauka Press, Moscow (USSR).
AN ALGORITHM FOR SEQUENTIAL DECODING WITH RECURRENCES **c61**
K. Sh. Zigangirov *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 43-48 refs In RUSSIAN (For availability see N75-15824 07-32)
Copyright.

An algorithm is presented for sequential decoding in which the mean work time is less than for the Fano algorithm, but larger than for the algorithm of sequential decoding according to the probability maximum. The volume of operative memory is found to be less than for the sequential coding algorithm, but more than for the Fano algorithm. The algorithm is described by the example of transmitting through a binary symmetric channel without a memory. Transl. by M.J.S.

N75-15830 Nauka Press, Moscow (USSR).
COMPUTATION OF VALUES AND ROOTS OF POLYNOMIALS ABOVE A FINITE FIELD **c64**
V. B. Afanasyev *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 49-55 refs In RUSSIAN (For availability see N75-15824 07-32)
Copyright.

An algorithm was constructed for calculating the values of polynomials in the subset GF(q). It was shown that in the case when the primitive element indicator of the field has more than 1ng simple divisors, the maximal number of operations for computing the set of values of a t-degree polynomial or the search for its roots has the form q1n t. Transl. by M.J.S.

N75-15831 Nauka Press, Moscow (USSR).
IMPROVING THE ERROR PROBABILITY EXPONENT IN A SYSTEM WITH FEEDBACK DURING THE USE OF A CASCADE CODE **c64**
V. V. Zyablov and L. F. Zhigulin *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 56-62 refs In RUSSIAN (For availability see N75-15824 07-32)
Copyright.

The modification is discussed of the method of transmitting discrete messages by using cascade codes in combination with ideal feedback. It is shown that by using binary symmetric channels without memory, the error probability decreases in its exponent with the growth of the mean length of the cascade code combination. The modification also increases the lower boundary of the error probability exponent. Transl. by M.J.S.

N75-15832 Nauka Press, Moscow (USSR).
INDICATION OF DISCRETE SIGNAL TRANSMISSION ACCURACY BY USING FEEDBACK
O. V. Popov *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 63-67 refs In RUSSIAN (For availability see N75-15824 07-32)
Copyright.

Approaches are formulated for analyzing the accuracy of discrete signal transmission during possible signal losses and inputs. Other topics discussed include temporary sequences, receivers, algorithms, transmitters, communication channels, and linear codes. Transl. by M.J.S.

N75-15833 Nauka Press, Moscow (USSR).
ANALYSIS OF A ONE-WAY ACTION SYSTEM WITH RETRANSMISSION AND EXPECTED RESULTS WITH THE METSNER-MORGAN ALGORITHM
L. F. Zhigulin *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 68-76 refs In RUSSIAN (For availability see N75-15824 07-32)
Copyright.

A one-way action system with retransmission was investigated by using results of the graph theory in the case of an independent group of combinations and feedback signals. The velocity of signal transmission and the coefficient for expanding signal sequence are also discussed. Transl. by M.J.S.

N75-15834 Nauka Press, Moscow (USSR).
COMPARISON OF A TWO-WAY ACTION SYSTEM WITH RETRANSMISSION AND EXPECTED RESULTS WITH THE BENICE-FRAY AND METSNER-MORGAN ALGORITHMS
L. F. Zhigulin *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 77-82 refs In RUSSIAN (For availability see N75-15824 07-32)
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A linear code used for signal transmission along direct and feedback channels is discussed. The two-way communications systems are analyzed and compared. The conditions of an independent group of linear (n,k)-code combinations were used for signal transmission with identical statistical error. It is found that for longer codes, the Metsner-Morgan algorithm is more applicable. Transl. by M.J.S.

N75-15835 Nauka Press, Moscow (USSR).
ANALYSIS OF A TWO-WAY ACTION SYSTEM WITH RETRANSMISSION AND EXPECTED RESULTS WITH THE SHWARTZ ALGORITHM
L. F. Zhigulin *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 83-89 refs In RUSSIAN (For availability see N75-15824 07-32)
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The characteristics of a two-way action system with a Schwartz algorithm were investigated by using the results of a graph theory. An analysis is carried out for the case when channels of direct and reverse directions are identical, and when one and the same linear code is used for the discrete signal transmission along these channels. The Schwartz algorithm system is compared with the similar Metsner-Morgan algorithm system.
Transl. by M.J.S.

N75-15836 Nauka Press, Moscow (USSR).
A SYSTEM WITH TEMPORARY SUBCHANNELS
L. F. Zhigulin *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 90-101 refs In RUSSIAN (For availability see N75-15824 07-32)
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A two-way communication system without obstructions and with independent temporary subchannels was constructed and analyzed on the basis of a retransmission system. A method was examined for increasing the transmission accuracy in this system. Another system with independent temporary subchannels is also described in which transmission along each subchannel depends on signal passage through the system's remaining subchannels. Transl. by M.J.S.

N75-15837 Nauka Press, Moscow (USSR).
CALCULATION OF FALLING OUT AND INSERTIONS OF INFORMATION DURING THE ANALYSIS OF TWO-WAY SYSTEM WITH RETRANSMISSION AND EXPECTED RESULTS
O. V. Popov and L. F. Zhigulin *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 102-113 refs In RUSSIAN (For availability see N75-15824 07-32)
Copyright.

The accuracy of discrete signal transmission in a two-way system with redemand and recurrence was investigated by considering the error possibility during feedback signal transmission. The mechanism of signal losses and inputs in such a system is explained along with the upper and lower boundaries of situations which cause these losses. Transl. by M.J.S.

N75-15838 Nauka Press, Moscow (USSR).
ANALYZING THE DISTRIBUTION OF INFORMATION TRANSMISSION TIME IN A SYSTEM WITH ADDRESS RETRANSMISSION
O. F. Dmitriyev and V. Ya. Turin *In its* Increasing the Accuracy

of Transmission of Digital Inform. on Discrete Channels 1974 p 114-119 refs In RUSSIAN (For availability see N75-15824 07-32)
Copyright.

A method is presented for calculating time distribution in signal transmissions. The calculations were based on the assumption that the error source in direct and reverse channels is described by using Markov chains with conditions and transition probability matrices. Transl. by M.J.S.

N75-15839 Nauka Press, Moscow (USSR).
DETERMINING THE PROBABILITY CHARACTERISTICS OF A SYMMETRIC DISCRETE CHANNEL WHOSE POSITIONS FORM A STATIONARY MARKOV CHAIN
O. V. Popov *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 120-129 refs In RUSSIAN (For availability see N75-15824 07-32)
Copyright.

For calculating probability characteristics, a model was used in which the sequence of channel conditions appears as a simple Markov chain. The calculation was reduced to a linear combination of matrix products whose dimensions do not exceed the number of channel conditions. Transl. by M.J.S.

N75-15840 Nauka Press, Moscow (USSR).
BOUNDARIES OF THE PROBABILITY CHARACTERISTICS OF A DISCRETE SYMMETRIC CHANNEL WHOSE POSITIONS FORM A STATIONARY MARKOV CHAIN c65
O. V. Popov *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 130-138 ref In RUSSIAN (For availability see N75-15824 07-32)
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A method is presented for producing the lower and upper boundary characteristics of some discrete channels which conform to a Markov model which allows simple computations. Error analysis and detection, and matrix products are also discussed. Transl. by M.J.S.

N75-15841 Nauka Press, Moscow (USSR).
UPPER AND LOWER BOUNDARIES OF THE PROBABILITY CHARACTERISTICS OF A DISCRETE CHANNEL WHICH CONFORMS TO THE MARKOV CASCADE MODEL c65
O. V. Popov *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 139-143 refs In RUSSIAN (For availability see N75-15824 07-32)
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Formulas are presented which are simpler than other formulas because of the smaller matrices produced. It is found that the error source on a cascade Markov model appears as a result of the Markov commutation of independent error sources, each of which is subordinate to a Markov model with those or other parameters. Transl. by M.J.S.

N75-15842 Nauka Press, Moscow (USSR).
USING MATRIX PRODUCTIVE FUNCTIONS FOR THE ANALYSIS OF TRANSMISSION ACCURACY IN A COMMUNICATION SYSTEM c64
V. Ya. Turin *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 144-154 refs In RUSSIAN (For availability see N75-15824 07-32)
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Matrix-producing functions for calculating accuracy indicators are discussed for discrete information transmission along channels in which error is described by Markov chains. Different distributions of error quantities are presented along with the intervals between them. A method is also discussed for producing approximate and asymptotic formulas on the basis of matrix-producing functions. Transl. by M.J.S.

N75-15843 Nauka Press, Moscow (USSR).
DISTRIBUTION OF EXPERIMENTAL PACKAGE LENGTHS FOR MODELS BASED ON THE MARKOV CHAINS c64
E. L. Blokh, E. M. Bakhar, and V. Ya. Turin *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 155-163 refs In RUSSIAN (For availability see N75-15824 07-32)
Copyright.

Productive functions of package length distributions were developed along with approximate and asymptotic formulas. The concept of the theoretical package is used for describing the majority of existing error source models; the package is a section of an error sequence in which errors originate independently of some probability epsilon. Three effects connected with the formation of experimental packages from theoretical ones are presented. Hilbert models and auxiliary matrices are also discussed. Transl. by M.J.S.

N75-15844 Nauka Press, Moscow (USSR).
DISTRIBUTION OF EXPERIMENTAL PACKAGE LENGTHS FOR ERROR SEQUENCE FORMING A PROCESS WITH FINITE REDUCTION TIME c64
E. M. Bakhar *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 164-170 refs In RUSSIAN (For availability see N75-15824 07-32)
Copyright.

Unidimensional distribution of lengths of a series of zeroes (errorless symbols), and lengths of a series of units (error symbols) were assumed to be independent. It is shown that these distributions determine the finite time reduction. Other topics discussed include recurrent relationships, productive functions, and error sequences. Transl. by M.J.S.

N75-15845 Nauka Press, Moscow (USSR).
CONSTRUCTING A MARKOV MODEL OF A DISCRETE SYMMETRIC CHANNEL ACCORDING TO EXPERIMENTAL DATA c64
O. V. Popov *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 171-178 refs In RUSSIAN (For availability see N75-15824 07-32)
Copyright.

An approach is presented for constructing a Markov model by the realization of an error sequence registered during test transmissions. The method is based on consecutive approximations of the desired model by direct development of different Markov chain conditions in a binary experimental error sequence. Transl. by M.J.S.

N75-15846 Nauka Press, Moscow (USSR).
DESCRIBING THE ERROR SOURCE IN SEVERAL CHANNELS
V. Ya. Turin *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 179-185 refs In RUSSIAN (For availability see N75-15824 07-32)
Copyright.

Error sources in several binary symmetrical communication channels are described with one Markov chain. Several characteristics of the error flow were calculated. It was found that the necessity of using an error source model in several channels is connected with the calculations of characteristics of information transmission accuracy in feedback systems (when channels of forward and reverse directions cannot be considered independent). Transl. by M.J.S.

N75-15847 Nauka Press, Moscow (USSR).
THE POSSIBILITY OF DIRECT MODELING OF AN EXPANDED CHANNEL
I. B. Petrovskiy *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 186-190 refs In RUSSIAN (For availability see N75-15824 07-32)
Copyright.

The direct modeling of an expanded channel is accomplished by using a Markov model of the original binary symmetrical channel. A method is described for constructing matrices of transition probabilities in a Markov chain suitable for direct modeling. Transl. by M.J.S.

N75-15848 Nauka Press, Moscow (USSR).
PHYSICAL MODELING OF COMMUNICATION CHANNELS
B. F. Kiryanov and A. G. Leontyev *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 191-194 refs In RUSSIAN (For availability see N75-15824 07-32)
Copyright.

Block schemes are presented of error sources in the installations of polygeometrical and cascade models of a binary channel. Other topics discussed include computer programs for

channel modeling, error sources, and random numbers.
Transl. by M.J.S.

N75-15849 Nauka Press, Moscow (USSR).
PRODUCING RANDOM PROCESSES WITH ASSIGNED STATISTICAL CHARACTERISTICS **c65**
Yu. N. Kalashnikov and A. G. Leontyev *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 195-201 refs In RUSSIAN (For availability see N75-15824 07-32)
Copyright.

Several methods of generating random flows with given statistical characteristics are presented along with methods for transforming them into continuous random processes in which a random number recorder is used as a master impulse generator. Other topics discussed include binomial flows, computer modeling, and data transmission. Transl. by M.J.S.

N75-15850 Nauka Press, Moscow (USSR).
SOME METHODS OF GENERATING MARKOV SEQUENCES **c64**
A. G. Leontyev, A. M. Morozov, and D. M. Sudakov *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 202-210 refs In RUSSIAN (For availability see N75-15824 07-32)
Copyright.

Three methods were investigated for generating a simple homogeneous Markov chain by using specialized installations. Algorithms for these methods are analyzed and block-diagrams for the generators are presented. The Monte Carlo method and data recorders are also discussed. Transl. by M.J.S.

N75-15851 Nauka Press, Moscow (USSR).
SELECTING A METHOD FOR PRODUCING N-DISCHARGING RANDOM NUMBERS **c64**
A. G. Leontyev *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 211-217 refs In RUSSIAN (For availability see N75-15824 07-32)
Copyright.

Several methods for producing N-discharging binary numbers are discussed, one of which recalculates the regular sequence of impulses after a random time interval. Random number recorders are described according to the formation of random binary number discharges. Sequences and the probability theory are also discussed. Transl. by M.J.S.

N75-15852 Nauka Press, Moscow (USSR).
A METHOD FOR PRODUCING PSEUDORANDOM NUMBERS ON A COMPUTER **c64**
I. B. Petrovskiy *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 218-220 refs In RUSSIAN (For availability see N75-15824 07-32)
Copyright.

A method is discussed for producing equally distributed pseudorandom numbers needed for computer solutions to different problems by using the Monte Carlo method. The results included improved statistical characteristics and small machine time losses. Transl. by M.J.S.

N75-15853 Nauka Press, Moscow (USSR).
CONDITIONS DURING WHICH A MARKOV FUNCTION BECOMES A MARKOV CHAIN **c64**
V. Ya. Turin *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 221-234 refs In RUSSIAN (For availability see N75-15824 07-32)
Copyright.

A reduction in the number of Markov chain conditions is presented for analyzing the error source model as a Markov source of disturbances, each of which causes independent distortions with constant conditional probabilities.
Transl. by M.J.S.

N75-15854* National Aeronautics and Space Administration. Pasadena Office, Calif.
SIMULTANEOUS ACQUISITION OF TRACKING DATA FROM TWO STATIONS **Patent**
Gordon E. Wood, inventor (to NASA) (JPL) Issued 14 Jan. 1975 8 p Filed 15 Nov. 1973 Supersedes N74-15838 (12 07, p 0760) Sponsored by NASA
(NASA-Case-NPO-13292-1; US-Patent-3,860,921; US-Patent-Appl-SN-416135; US-Patent-Class-343-6.5R; US-Patent-Class-343-9; US-Patent-Class-343-17.5; US-Patent-Class-343-100ST) Avail: US Patent Office CSCL 17B

A method and apparatus is described for obtaining simultaneous tracking data from two ground stations relative to a spacecraft, and in particular for obtaining two-way range and Doppler measurements with respect to the spacecraft using only one transponder on the spacecraft. The technique employs simultaneous transmission from two stations to produce a return signal with upper and lower sidebands resulting from the interference of the two transmissions. A transponder transmits the upper and lower sidebands centered about a carrier received by both stations. One station tracks the carrier and the other tracks a sideband aided by the carrier.
Offical Gazette of the U.S. Patent Office

N75-15855 British Broadcasting Corp., Kingswood (England). Research Deptj
DIGITAL VIDEO: ERROR CORRECTING CODES AND A PRACTICAL STUDY OF A WYNER-ASH ERROR CORRECTOR
J. H. Stott, A. Oliphant, D. W. Osborne, and C. Eng Dec. 1974 23 p refs
(BBC-RD-1974/40) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The use of error correcting codes for digital video transmission is discussed along with the experimental implementation of one such error correction scheme, the Wyner-Ash convolution code. Other topics discussed include parity checking, single and multiple bursts error correcting codes, interlacing, Hamming codes, and the experimental digital video error coder. Author

N75-15856*# Stanford Univ., Calif. Inst. for Plasma Research.
ANALYSIS OF THE BACKSCATTER SPECTRUM IN AN IONOSPHERIC MODIFICATION EXPERIMENT
H. Kim, F. W. Crawford, and K. J. Harker Dec. 1974 31 p refs
(Grant NGL-05-020-176)
(NASA-CR-142015; SU-IRR-609) Avail: NTIS HC $3.75 CSCL 04A

Predictions of the backscatter spectrum, including effects of ionospheric inhomogeneity, are compared with experimental observations of incoherent backscatter from an artificially heated region. Our calculations show that the strongest backscatter echo received is not from the reflection level, but from a region some distance below. Certain asymmetrical features are explained of the up-shifted and down-shifted plasma lines in the backscatter spectrum, and the several satellite peaks accompanying them.
Author

N75-15857*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
ANTENNA PERFORMANCE AND RESOLUTION
J. J. Carney Nov. 1974 26 p
(Contract NAS9-12200)
(NASA-CR-141556; LEC-4946) Avail: NTIS HC $3.75 CSCL 17B

The performance of the antenna throughout SL-2, SL-3, and SL-4 was investigated along with the antenna resolution of brightness temperature during flight. The target area selected for the test flights was the Gulf of California, as it offered land/water interface. The coordinate transformations and antenna orientation, flight path simulation, and integration over the radiometric target are discussed. F.O.S.

N75-15858*# City Coll. Research Foundation, New York. Communications Systems Lab.
OPTIMAL SPACE COMMUNICATIONS TECHNIQUES
Semiannual Report, 27 Jun. - 26 Dec. 1974
Donald L. Schilling 26 Dec. 1974 73 p refs
(Grant NsG-5013)
(NASA-CR-142071) Avail: NTIS HC $4.25 CSCL 17B

The encoding of video signals using the Song Adaptive Delta Modulator (Song ADM) is discussed. The video signals are

characterized as a sequence of pulses having arbitrary height and width. Although the ADM is suited to tracking signals having fast rise times, it was found that the DM algorithm (which permits an exponential rise for estimating an input step) results in a large overshoot and an underdamped response to the step. An overshoot suppression algorithm which significantly reduces the ringing while not affecting the rise time is presented along with formuli for the rise time and the settling time. Channel errors and their effect on the DM encoded bit stream were investigated. M.J.S.

N75-15859# Technische Universitaet, Munich (West Germany).
CURRENT DISTRIBUTION, NEAR FIELD AND ENERGY FLOW OF BACKFIRE ANTENNAS Ph.D. Thesis [STROMVERTEILUNG, NAHFELD UND ENERGIEFLUSS BEI BACKFIRE-ANTENNEN]
Philipp Federspieler 23 Jul. 1974 20 p refs In GERMAN
Avail: NTIS HC $3.25

Near field analysis and current measurements are used to determine the resonant behavior of short backfire antennas. Hollow guide resonances are observed when reflecting collars are used. Superposition of various standing wave modes develops a propagating wave. Transl. by G.G.

N75-15860# Mitre Corp., Atlantic City, N.J.
RADAR TARGET DETECTION EMPLOYING ON-LINE ESTIMATION OF THE VIDEO CORRELATION Final Report
Lakshman P. Sinha May 1974 76 p refs
(Contract DOT-FA69NS-162)
(AD-787687; MTR-4240; FAA-RD-74-164) Avail: NTIS CSCL 17/9

The Report presents a new target detection scheme for sliding window detectors. The scheme calls for adaptively adjusting leading and trailing edge target detection threshold based upon the existing coefficient of correlation between the consecutive radar returns. The coefficient of a correlation is estimated on-line by examining the ZERO-ONE pattern over a window of fixed size every scan, and updating the estimate for a specified number of scans using a least square error estimation technique. The number of scans is selected as a parameter. The recursive estimation technique facilitates the estimation of the coefficient of correlation with minimal storage requirements. A constant check on the coefficient of correlation between consecutive radar returns is made by repeating the process of on-line estimation and selection of a new set of leading and trailing edge thresholds after every preset time interval. This preset time interval reflects the time span during which the weather may be considered constant over a certain area. (Modified author abstract) GRA

N75-15861# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
DISTORTION EFFECTS IN PHASE-CODED RADARS WITH DIGITAL SIGNAL PROCESSING
A. D. Goldfinger Nov. 1973 54 p refs
(Contract N00017-72-C-4401)
(AD-787513; APL-TG-1228) Avail: NTIS CSCL 17/9

The effects of single-bit digital signal processing upon the output of a phase-coded radar are considered. When a point target is viewed, the system response is approximately linear as long as the input signal-to-noise ratio is small compared to unity. The output signal-to-noise ratio is 2/pi times the value it would have for a truly linear analog system. When a target extending across R - 1 range bins is viewed, the system response will be linear as long as the input signal-to-noise ratio is small compared to 1/R. Theoretical results are compared with a Monte Carlo simulation. (Modified author abstract) GRA

N75-15862# Naval Undersea Warfare Center, San Diego, Calif.
IMAGE TRANSMISSION VIA SPREAD SPECTRUM TECHNIQUES Quarterly Technical Report, 2 Jan. - 1 Jul. 1974
Robert W. Means, Jeffrey M. Speiser, and Harper J. Whitehouse 1974 150 p refs
(ARPA Order 2303)
(AD-787502; QTR-4) Avail: NTIS CSCL 17/2

This report addresses the design of a spread spectrum image transmission system to provide increased antijam protection to a television link from a small remotely piloted vehicle. Previous quarterly reports have described component developments, theoretical advances in image processing, and simulations of proposed coding schemes. This report summarizes the proposed total system. Author (GRA)

N75-15863# Stanford Univ., Calif. Inst. for Communication Research.
HEALTH CARE AND SATELLITE RADIO COMMUNICATION IN VILLAGE ALASKA: FINAL REPORT OF THE ATS-1 BIOMEDICAL SATELLITE EXPERIMENT EVALUATION Final Report
Osvaldo Kreimer, Heather Hudson, Dennis Foote, Virginia Hunn Fowkes, and Bruce Lusignan Jun. 1974 430 p refs
(Contract N01-LM-1-4718)
(PB-235601/2; LHNCBC-75-01) Avail: NTIS HC $11.25 CSCL 17B

Results of an in-depth evaluation of the use of two-way satellite radio to improve health care in the Alaskan bush are presented. The uses examined include communication between native health aides and doctors, between an isolated doctor and his colleagues, and continuing education. A vast increase over the old HF radio system in the number of cases seen, high predicted effects in patient welfare as a result of the consultations, improved handling of emergency cases, and changes in the hospitalization patterns is reported. The doctor-to-doctor and the continuing education experiments were successful. Technical planning for an operational system using existing satellites is reported, and recommendations for action and for future research are made. GRA

N75-15864# Auburn Univ., Ala. Engineering Experiment Station.
FREQUENCY AGILITY AND RADAR POINTING ERRORS DUE TO MULTIPATH Interim Technical Report
David G. Burks, Harold V. Poor, Zeb. L. Burrell, III, and Edward R. Graf 1 Oct. 1974 135 p refs
(Contract DAAH01-71-C-1303)
(AD-787390) Avail: NTIS CSCL 17/9

A radar model for ground reflection multipath is described. The use of frequency agility in an environment where pointing errors are caused by multipath is demonstrated. The radar target is a collection of ellipsoids designed to approximate the surface of an aircraft. A statistically rough surface with a large and small roughness scale is used to model the terrain around the antenna. It is shown that frequency agility can be used to obtain uncorrelated errors at the different transmit frequencies. Author (GRA)

N75-15865# Naval Research Lab., Washington, D.C.
A SURVEY OF CANCELLATION VERSUS INTEGRATION FOR RADAR CLUTTER REFLECTION
Geoffrey C. Bagley Aug. 1974 21 p refs
(NRL Proj. R02-65; RF12151402)
(AD-787623; NRL-MR-2880) Avail: NTIS CSCL 17/9

Moving target indicators for radar systems may be represented by two classes; the delay line canceller approach and the pulse Doppler approach. The relative merits of these approaches are considered along with tradeoffs required to meet radar system performance goals. Author (GRA)

N75-15866# National Aviation Facilities Experimental Center, Atlantic City, N.J.
TEST AND EVALUATION OF THE PASSIVE FEEDHORN FOR THE AIR ROUTE SURVEILLANCE RADAR (ARSR-2) Final Report, Mar. - May 1973
Clifford Chapman Sep. 1974 35 p
(FAA Proj. 022-241-010)
(AD-786704; FAA-NA-74-10; FAA-RD-74-138) Avail: NTIS CSCL 09/5

A modified dual feedhorn antenna assembly for the air route surveillance radar (ARSR-2) was evaluated on a comparison basis with the normal feedhorn in attaining optimum radar coverage. Data indicated that ground clutter at close-in radar ranges was significantly reduced by use of a high-angle antenna beam (passive feedhorn) resulting in improvement in signal-to-clutter response at these ranges. Installation of the dual feedhorn antenna assembly as a field modification is considered feasible. Author (GRA)

N75-15867# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COHERENT RECEPTION OF RADIONAVIGATIONAL SIGNALS
A. E. Lutchenko 30 Sep. 1974 305 p Transl. into ENGLISH of the book "Kogerentnyi Priem Radionavigatsionnykh Signalov" 1973 p 1-208
(AD-787407; FTD-HC-23-945-74) Avail: NTIS CSCL 09/4

The book deals with statistical analysis of coherent reception of radio signals against a background of fluctuation noise and sinusoidal noise. The exposition is devoted chiefly to discrete methods of information processing with consideration of shifts in the signal frequency and reference oscillator frequency. The procedures of analysis are illustrated by hypothetical examples of engineering calculation of the characteristics of signal detectors and the instruments for measuring their parameters. Although the analysis is based on radionavigation signals, most of the methods and results are applicable to coherent signals of any system. Certain results obtained by the author are included.
Author (GRA)

N75-15868# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
CRITERIA FOR EVALUATING THE COST EFFECTIVENESS OF OPTICAL CHARACTER RECOGNITION EQUIPMENT IN BASE TELECOMMUNICATIONS CENTERS M.S. Thesis
William B. Johnston and Freeland K. Abbott, Jr. Aug. 1974 97 p refs
(AD-787197; SLSR-36-74B) Avail: NTIS CSCL 09/2

The objective of this research was to develop and demonstrate a method for calculating the cost effectiveness of Optical Character Recognition Equipment (OCRE) in military communications centers. Six AFLC bases were studied and a break-even cost for OCRE was developed for four of the bases: Wright-Patterson, Tinker, Robins, and Hill. Elements of cost of the current system considered were personnel, teletype equipment, and paper. No survey was made of OCR devices on the market to see if a specific device would be cost effective; rather, prices at which OCR devices of various capabilities would become cost effective were developed. Single and multifont OCR capabilities in both 10 and 12-pitch were considered. Author (GRA)

N75-15869# Naval Electronics Lab. Center, San Diego, Calif.
TRANSMITTER/ANTENNA COUPLER DIPLEX CONTROL SYSTEM: ELIMINATES MULTIPLE-WIRE CONTROL CABLES: LIMITS SWITCHING TO SINGLE-CONDUCTOR RF COAXIAL CABLE Research and Development Report, Aug. 1973 - Mar. 1974
A. R. Evans 11 Jul. 1974 36 p
(NELC Proj. B187; SF21222013)
(AD-787485; NELC-TR-1926) Avail: NTIS CSCL 17/2

In an existing hf transmitter/antenna coupler complex in which an RF automatic or manual switching matrix is to be employed, the information carried by the multiple-wire control cables must be switched in parallel with the information carried by the coaxial RF cable. This report describes the development and testing of a multiple-tone encoded diplexing system which eliminates the multiple-wire control cables, reducing the switching requirement to handling the single-conductor RF coaxial cables.
Author (GRA)

N75-15870# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MODELS OF THE SOURCE OF ERRORS IN TRANSMISSION CHANNELS OF DIGITAL INFORMATION
E. L. Blokh and O. V. Popov 31 Jul. 1974 418 p refs Transl. into ENGLISH of the book "Modeli Istochnika Oshibok v Kanalakh Peredachi Tsifrovoi Informatsii" Moscow, 1971 312 p
(AD-786119; FTD-MT-24-516-74) Avail: NTIS CSCL 09/4

The book deals with the investigation of questions of the mathematical description of the laws governing the emergence of errors in the real transmission channels of digital information. General models are given which reflect these laws, and their most important special cases. The methodology is stated for the construction of such models on the basis of experimental data relating to some telephone channels. GRA

N75-15871# Naval Reesearch Lab., Washington, D.C.
ADAPTIVE TRACKING ALGORITHM FOR TRACKING AIR TARGETS WITH SEARCH RADARS Interim Report
B. H. Cantrell 23 Sep. 1974 14 p refs
(NRL Proj. R02-97; RR0210541)
(AD-787635; NRL-7805) Avail: NTIS CSCL 17/9

An apaptive alpha - beta filter used to track targets by search radars is described. The gains alpha and beta are adjusted so as to minimize the mean square error between the target's predicted and measured positions. Several examples are given. These show that the filter responds rather rapidly to changing environments for a time between samples of 4 s. Author (GRA)

N75-15872# Speech Communications Research Lab., Inc., Santa Barbara, Calif.
INVERSE FILTER FOR SPEAKER IDENTIFICATION Final Report, 5 Apr. 1973 - 4 Apr. 1974
Larry L. Pfeifer Aug. 1974 113 p refs
(Contract F30602-73-C-0243; AF Proj. 7055)
(AD-787860; RADC-TR-74-214) Avail: NTIS CSCL 05/7

The objective of a speaker identification task is to determine if a sample of speech from an unknown talker can be associated with a sample of speech from one of several reference talkers. Of the many different techniques for performing speaker identification, the method of comparing feature vectors from individual sound elements was chosen for identification experiments. The experiments utilized the inverse filter analysis technique, which is also described as the autocorrelation method of linear prediction. Text-dependent identification experiments were performed with a population of ten male talkers whose speech samples were bandlimited to 3250 Hz. Thirteen sound units, 10 vowels and 3 nasals, were chosen as the elements from which feature vectors would be extracted. Many additional identification tests were performed for the purpose of evaluating different distance functions and different feature vectors. (Modified author abstract) GRA

N75-15873# Harvard Univ., Cambridge, Mass. Program on Information Technologies and Public Policy.
A REVIEW OF EDWARD M. DICKSON, IN ASSOCIATION WITH RAYMOND BOWERS, THE VIDEO TELEPHONE, A NEW ERA IN TELECOMMUNICATIONS, A PRELIMINARY TECHNOLOGY ASSESSMENT, ITHACA, NEW YORK: PROGRAM ON SCIENCE, TECHNOLOGY AND SOCIETY, CORNELL UNIVERSITY, JUNE 1973, 241 PAGES
Anthony G. Oettinger, Peter D. Shapiro, Edward M. Dickson, and Raymond Bowers 19 Feb. 1974 24 p refs
(PB-235145/0; Pub-P-74-1) Avail: NTIS HC $3.25 CSCL 17B

An assessment of the current status of video telephone development and of the broad societal implications of future operating video telephone services are reviewed. Factual descriptions of relevant technologies and hypotheses about possible impacts on society are given. GRA

N75-16287 British Aircraft Corp. (Operating) Ltd., Bristol (England). Commercial Aircraft Div.
TRAFFIC MODELLING OF MILITARY COMMUNICATION SYSTEMS ON DIGITAL COMPUTERS
D. V. Turner *In* AGARD Real Time Computer Based Systems Dec. 1974 10 p (For availability see N75-16257 07-62)

N75-16429* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMMUNICATIONS AND NAVIGATION
In its Significant Accomplishments in Sci. and Technol. 1975 p 250-289 (For availability see N75-16422 07-88)
CSCL 17B

N75-16431* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NETWORKS SYSTEMS AND OPERATIONS
In its Significant Accomplishments in Sci. and Technol. 1975 p 320-348 (For availability see N75-16422 07-88)
CSCL 17B

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N75-15874* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

VARIABLE FREQUENCY INVERTER FOR ac INDUCTION MOTORS WITH TORQUE, SPEED AND BRAKING CONTROL Patent

Frank J. Nola, inventor (to NASA) Issued 14 Jan. 1975 6 p Filed 19 Dec. 1973 Supersedes N74-13894 (12 - 05, p 0510)

(NASA-Case-MFS-22088-1; US-Patent-3,860,858; US-Patent-Appl-SN-426155; US-Patent-Class-318-227; US-Patent-Class-318-230; US-Patent-Class-318-231) Avail: US Patent Office CSCL 09E

A variable frequency inverter was designed for driving an ac induction motor which varies the frequency and voltage to the motor windings in response to varying torque requirements for the motor so that the applied voltage amplitude and frequency are of optimal value for any motor load and speed requirement. The slip frequency of the motor is caused to vary proportionally to the torque and feedback is provided so that the most efficient operating voltage is applied to the motor. Winding current surge is limited and a controlled negative slip causes motor braking and return of load energy to a dc power source.

Official Gazette of the U.S. Patent Office

N75-15875 Polish Academy of Sciences, Warsaw.

APPLICATION OF A UNIFORM ASYMPTOTIC THEORY OF DIFFRACTION TO THE ANALYSIS OF OPEN WAVEGUIDES [ZASTOSOWANIE JEDNOLITEJ ASYMPTOTYCZNEJ TEORII DYFRAKCJI DO ANALIZY OTWARTEGO FALOWODU]

Adam Ciarkowski 1973 54 p refs In POLISH

(Rept-21/1973) Avail: Issuing Activity

Solutions for high frequency diffraction problems in an open space were investigated. The asymptotic theory was used for analyzing open waveguide discontinuity. Other topics discussed include geometric theory of diffraction, electromagnetic problems, Hertz vectors, Helmholtz equations, and boundary value problems.

Transl. by M.J.S.

N75-15876*# National Aeronautics and Space Administration. Pasadena Office, Calif.

THE dc-TO-dc CONVERTERS EMPLOYING STAGGERED PHASE POWER SWITCHES WITH TWO LOOP CONTROL Patent Application

Gene W. Wester, inventor (to NASA) (JPL) Filed 17 Dec. 1974 15 p

(Contract NAS7-100)

(NASA-Case-NPO-13512-1; US-Patent-Appl-SN-533734) Avail: NTIS HC $3.25 CSCL 09C

Boost, buck and buck-boost dc-to-dc converters are described that employ parallel staggered-phase power switches with two-loop control. A switched inductor voltage is coupled to a sense winding in each phase, and all sense windings are connected in series to one of two feedback loops to provide a signal that indicates when one of the power switches is on as the principal determinant of switching instants. A sequencer is triggered each time a pulse generator is triggered to turn on a different power switch in sequence at each switching instant.

NASA

N75-15877*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DESIGN OF AUTOMATIC STARTUP AND SHUTDOWN LOGIC FOR A BRAYTON-CYCLE 2- TO 15-KILOWATT ENGINE

James E. Vrancik and Richard C. Bainbridge Washington Feb. 1975 25 p refs

(NASA-TM-X-3181; E-8089) Avail: NTIS HC $3.25 CSCL 09C

The NASA Lewis Research Center is conducting a closed-Brayton-cycle power conversion system technology program in which a complete power system (engine) has been designed and demonstrated. This report discusses the design of automatic startup and shutdown logic circuits as a modification to the control system presently used in this demonstration engine. This modification was primarily intended to make starting the engine as simple and safe as possible and to allow the engine to be run unattended. In the modified configuration the engine is started by turning the control console power on and pushing the start button after preheating the gas loop. No other operator action is required to effect a complete startup. Shutdown, if one is required, is also effected by a simple stop button. The automatic startup and shutdown of the engine have been successfully and purposefully demonstrated more than 50 times at the Lewis Research Center during 10,000 hours of unattended operation. The net effect of this modification is an engine that can be safely started and stopped by relatively untrained personnel. The approach lends itself directly to remote unattended operation.

Author

N75-15878# United Kingdom Atomic Energy Authority, Harwell (England).

HIGH VOLTAGE LABORATORIES HONEYWELL DDP 516. THE EBERAS SYSTEM (EVENT BY EVENT RECORDING AND SORTING). PART 1: USER GUIDE

B. W. Hooton May 1974 45 p

(AERE-M-2637-Pt-1) Avail: AEC Depository Libraries HC $5.25

The EBERAS system (Event By Event Recording And Sorting) is a special purpose system designed for taking data from four position sensing detectors, which are used in the focal plane of a magnetic spectrograph to determine the energy and radius of bending of charged particles in a magnetic field. A general description is given of the system, followed by sections dealing with the electrons, the use of the DDP 516, and the special test pulse facility. The main part of the guide deals with the system software, under the following headings: accumulation of data, spectrum directory, display of spectra, spectrum transfer, display expansion facilities, input parameters, particle type selection, magnetic tape manipulation, plotting, spectrum stabilization, data playback and monitoring aids.

NSA

N75-15879# Joint Inst. for Nuclear Research, Dubna (USSR).

MODEL OF A HIGH-CURRENT AND HIGH-VOLTAGE SUPERCONDUCTING SWITCH

Kh. Menke and Yu. A. Shishov 1974 25 p refs In RUSSIAN

(JINR-P8-7855) Avail: AEC Depository Libraries HC $4.25

The problems concerning the construction and manufacture of switches, working in the circuits for energy evacuation from superconducting magnets or for energy transfer from inductive storage systems, are discussed. Nb-Ti filaments 65 mu m in diameter embedded in epoxy resin were used. A model switch with thermal control was manufactured. The following parameters were obtained: critical current 920 A, resistance in the normal state 2.5 ohms, minimal switching time 0.35 msec.

Author (NSA)

N75-15880# Bendix Corp., Kansas City, Mo.

AUTOMATIC PEAK POWER MEASUREMENT OF SHORT RF PULSES

K. E. Hardinger and E. E. Peterson Aug. 1974 10 p refs

(Contract AT(29-1)-613)

(BDX-613-1046) Avail: NTIS HC $3.25

A method was needed to measure the peak radiofrequency (RF) power of short-width RF pulses of the type used in telemetry and radar. A closed-loop pulse height leveling system was developed that can be constructed from readily available original equipment manufacturer microwave and electronic components. The system measures peak power, to within + or - 0.5 db, of pulsed or CW RF signals.

Author (NSA)

N75-15881# Bendix Corp., Kansas City, Mo.

EARLY PRODUCTION HISTORY ON HYBRID MICROCIRCUITS CONTAINING BEAM-LEAD SEMICONDUCTORS

T. A. Wiley Aug. 1974 29 p refs

(Contract AT(29-1)-613)

(BDX-613-1116-Rev) Avail: NTIS HC $3.75

Data from hybrid microcircuit prototype development and early coded electronic-switch production revealed that the beam-lead devices used in these hybrids are more reliable than the chip-and-wire active devices used in previous applications. Yields at the various processing levels were better than expected, and the overall microcircuit yield was more than 50 percent. Because of stringent quality requirements, this yield is considered acceptable, but is improving with cumulative production experience. Seven types of microcircuits for the coded switch are now being manufactured on a scheduled basis, and current problems are not sufficient to adversely affect production schedules. Author (NSA)

N75-15882# Bendix Corp., Kansas City, Mo.

ACTIVE LASER TRIMMER FOR PRODUCTION TRIMMING OF FUNCTIONAL HYBRID MICROCIRCUITS

J. A. Peters [1974] 4 p Presented at 1974 Symp. of the Intern. Society for Hybrid Microcircuits, Boston, 21-23 Oct.

(Contract AT(29-1)-613)

(BDX-613-1182; Conf-741004-2) Avail: NTIS HC $3.25

The output functions for hybrid microcircuits are required to be within one percent or better of design value. A computer-controlled YAG laser trimmer was developed to increase the resistance of the deposited resistors that control output functions such as voltage, current, frequency, and time interval. The computer program contains information on each circuit transfer function and each related trim resistor to predict the required cut length. This system makes use of repetitive sampling during a short interval when power is applied to the circuit, and trimming is performed during a much longer interval when power is off. This provides for rapid trimming of functions with short duty cycles. Early results show that the active laser trimmer is a satisfactory production method for obtaining close-tolerance electrical functions. Author (NSA)

N75-15883# California Univ., La Jolla. Dept. of Physics.

PRINCIPLES AND METHODS OF LOW FREQUENCY ELECTRIC AND MAGNETIC MEASUREMENTS USING AN RF BIASED POINT CONTACT SUPERCONDUCTING DEVICE

R. P. Giffard, R. A. Webb, and J. C. Wheatley [1972] 160 p refs

(Contract AT(04-3)-34)

(UCSD-34P143-45) Avail: NTIS HC $6.25

A comprehensive study has been made of some low frequency electric and magnetic measurements which can be made using an rf biased point contact superconducting device of the symmetric two-hole type introduced by Zimmerman. Measurements of the mutual inductance due to a 1.6 mg crystal of CMN are described in which the crystal temperature was reduced to the millidegree region. Measurements of static magnetization are discussed and the ideas applied to measurement of temperature using milligram quantities of CMN. Measurements using a pair of thermometers, one inside and the other outside the mixing chamber of a dilution refrigerator, are presented. The concept of a device noise temperature is introduced and shown to be in the microdegree region. A very simple Johnson noise thermometer is described. Measurements with this thermometer in the mixing chamber of a dilution of refrigerator were carried out to 12 mK, the effective device temperature being measured to be (-1.4 + or - 2.3) mK. A qualitative experimental estimate places the actual device temperature well below one millidegree. A technical discussion of the flux-locked loop and of noise is given. Author (NSA)

N75-15884# IIT Research Inst., Chicago, Ill. Reliability Analysis Center.

MICROCIRCUIT RELIABILITY BIBLIOGRAPHY. VOLUME 1: CUMULATIVE INDEX. VOLUME 2: CUMULATIVE REFERENCES

Apr. 1974 485 p refs

(Contract F30602-73-C-0065; AF Proj. 6251E)

(AD-786287; RADC-MRB-0474-Vol-1/2) Avail: NTIS CSCL 09/5

The bibliography identifies selected literature pertinent to the reliability of microelectronic devices. The complete bibliography is in two volumes. Volume I contains computer-prepared subject term and corporate author indices which cross reference to bibliographic references listed in Volume II. The volume contains over 2500 citations which are selected from the Reliability Analysis Center's file holdings. Citations include complete bibliographic information and descriptive abstracts. The two volumes, when used together, enable the engineer or technical librarian to perform retrospective information searches in a wide variety of pertinent subject areas. Author (GRA)

N75-15885# Alabama Univ., University. Bureau of Engineering Research.

AN INVESTIGATION OF CURRENT MODE SECOND BREAKDOWN Final Report, 1 Nov. 1973 - 31 Jul. 1974

W. D. Raburn Jul. 1974 34 p refs

(Grant DAHC04-74-6-0043)

(AD-787519; BER-177-93; AROD-12079-1-RTL) Avail: NTIS CSCL 09/1

A discussion is given on current mode second breakdown and related effects. A general description of second breakdown for different circuit configurations is given. Mathematical and physical models are given that show the causes of current mode second breakdown and the levels at which it occurs. The unstable voltage and current ranges and the associated oscillations are discussed. Computer solutions are given for the sustaining voltage for several different doping profiles. Finally a discussion is given on breakdown voltages in punch through limited transistors. Author (GRA)

N75-15886# R and D Associates, Santa Monica, Calif.

TRANSIENT UPSET TOLERATION AS AN EMP HARDENING TECHNIQUE

W. R. Graham and J. B. Houston 5 Aug. 1974 26 p

(Contract DNA001-72-C-0197; DNA Proj. NWED-P99QAXD) (AD-787620; RDA-TR-2301-010; DNA-3388T) Avail: NTIS CSCL 09/3

Both transient circuit upset and permanent component damage can produce serious malfunctions in modern electronics eq ipment. Although the issue is not yet clear, it may be possible to design and select components which have a much higher threshold to permanent damage than to transient upset. If this proves to be possible, then a degree of electromagnetic pulse (EMP) hardness would be achieved through designing systems to be completely insensitive to the effects of transient circuit upset. In the paper, the characteristics of the developed techniques for tolerating transient upset are described, various overall system design approaches are discussed, and the relation of specific upset toleration techniques to the system design approaches are illustrated. (Modified author abstract) GRA

N75-15887# Raytheon Co., Waltham, Mass. Research Div.

SPINEL FERRITES FOR PHASE SHIFTERS FOR AIRBORNE PHASED-ARRAY ANTENNAS Final Technical Report, 1 May 1972 - 30 Apr. 1974

H. J. VanHook and J. J. Green Sep. 1974 117 p refs

(Contract F33615-72-C-1524; AF Proj. 7371)

(AD-787848; S-1693; AFML-TR-74-146) Avail: NTIS CSCL 09/5

Lithium ferrite materials for avionic phased array applications at Ku- and X-band were developed by using conventional methods of ceramic processing and firing. Composition variables of Mn, Ti, and Co substitution were used to adjust the magnetic properties to the intended use. Bismuth oxide additions in the range of 0-0.2 wt. percent were used to alter the sintering and grain growth characteristics. Correlations were made between the resulting microstructures and structure sensitive magnetic properties. The stress sensitivity was determined on dense ceramics for different magnetizations and as a function of Mn and Co content. The Co concentration and not Mn was found to be the determining factor. Where single-crystal data were available, correlation was found between sign and magnitude in stress sensitivity and in the anisotropy constant K sub 1. The correlation of stress dependence and the single crystal magnetostriction coefficients was only weakly apparent. (Modified author abstract) GRA

N75-15888# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

COUPLING BETWEEN A CENTER-DRIVEN DIPOLE AND PARASITIC ELEMENTS OF DIFFERENT LENGTHS Physical

Sciences Research Papers
Charles J. Drane, Jr. 19 Jun. 1974 51 p refs
(AF Proj. 5635)
(AD-787650; AFCRL-PSRP-594; AFCRL-TR-74-0279) Avail: NTIS CSCL 09/5

Formulas are derived as approximate representations for the current and charge distributions along the elements of a linear array of parallel, nonstaggered cylindrical wires of generally unequal length. One element is a center-driven dipole electromagnetically coupled to the other elements, which are parasitic. These formulas are derived in extension of the well-known King-Wu three-term theory. As such, they represent an improvement--particularly for the charge distributions, which often very so rapidly near the driving point of the driven element that they cannot be handled by the simpler trigonometric terms of the three-term theory. As in the three-term theory, there are only three unknown coefficients to be evaluated for each antenna element. (Modified author abstract) GRA

N75-15889# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ADVANCED ELECTRONIC TECHNOLOGY Quarterly Technical Summary Report, 1 May - 31 Jul. 1974
Melvin A. Herlin and Alan L. McWhorter Aug. 1974 20 p
(Contract F19628-73-C-0002; AF Proj. 649l)
(AD-787882; ESD-TR-74-241) Avail: NTIS CSCL 09/1

The Quarterly Technical Summary covers the period 1 May through 31 July 1974. It consolidates the reports of Division 2 (Data Systems) and Division 8 (Solid State) on the Advanced Electronic Technology Program. Author (GRA)

N75-15890# Stanford Univ., Calif. Microwave Lab.
MICROWAVE ACOUSTIC AND BULK DEVICE TECHNIQUE STUDIES Interim Report, 1 Nov. 1973 - 30 Apr. 1974
Sep. 1974 28 p refs
(Contract F30602-74-C-0038)
(AD-787869; ML-2303; RADC-TR-74-231) Avail: NTIS CSCL 09/1

A monolithic parametric signal processor was developed using zinc oxide thin film transducer structures on an epitaxial gallium arsenide substrate. The overall efficiency of the present device is approximately 30dB greater than obtained for a comparable device constructed entirely of lithium niobate, as a result of the increased linearity of the gallium arsenide and the efficient zinc oxide Rayleigh wave transducers. The interaction region is extremely uniform, as demonstrated by the nearly theoretical performance of the function of pulse compression of 13 bit biphase Barker coded waveforms. Efficient interdigital couplers were made for surface acoustic wave devices on silicon by rf sputter depositions of ZnO, a piezo-electric material, on the Si substrate. A monolithic acoustic surface wave convolver was constructed using this technique and an accurate theory of its operation was derived. (Modified author abstract) GRA

N75-15891# TRW Systems Group, Redondo Beach, Calif.
K-BAND ANTENNA PEDESTAL GROUP Final Report
C. Smith, J. Wu, and W. Jones Aug. 1974 350 p
(Contract N00123-73-C-0947)
(AD-787726) Avail: NTIS CSCL 09/5

The report contains technical and program information relating to the design fabrication test and delivery of the K-Band Antenna Pedestal Group. It provides a description of the delivered equipment, the design data used during the development and fabrication process, and the test criteria and test results. GRA

N75-15892# Purdue Research Foundation, Lafayette, Ind.
CONDUCTION MECHANISMS IN THICK FILM MICROCIRCUITS Semiannual Technical Report, 1 Jan. - 30 Jun. 1974
R. W. Vest 1 Aug. 1974 34 p refs
(Grant DAHC15-73-G-8; ARPA Order 1001)
(AD-787487) Avail: NTIS CSCL 09/5

It was demonstrated that neither direct observation of neck growth nor measurements of the shrinkage of composites can be applied to establish initial stage sintering kinetics for RuO2 in the presence of glass. Three secondary measurement techniques (microstructure determination, X-ray line broadening, and surface area measurements) were employed and results were shown to be consistent among the three techniques. Studies of the ripening process whereby large crystals of RuO2 grow in the glassy matrix uncovered a strong chemical interaction between the glass and the alumina substrate which significantly influences the rate of the ripening process. In particular, the substrate tends to inhibit the growth of RuO2 crystals, which is a desirable situation if the conductive network is to be preserved. Author (GRA)

N75-15893# Spectronics, Inc., Richardson, Tex.
IMPROVED GALLIUM ARSENIDE LIGHT EMITTING DIODES Technical Report, 21 May 1973 - 30 Jun. 1974
Edward Mehal Jun. 1974 24 p refs
(Contract DAAH01-73-C-0854)
(AD-787467) Avail: NTIS CSCL 09/1

The objective of the contract was to investigate Liquid Phase Epitaxial Process modifications which could lead to the high yield fabrication of high power domed LED's with high quantum efficiencies. The process modifications investigated included (1) growth in a slider boat, (2) growth of an additional p + layer and (3) growth of a p + GaAlAs epitaxial layer. The materials from the different growth methods were evaluated using a flat chip emitter and dome emitters were fabricated from the material which appeared most promising in the test procedure. The highest quantum efficiency devices were fabricated from material which did not have second layers grown on and which had p-layers which were greater than 0.002 inches thick.
Author (GRA)

N75-15894# Illinois Univ., Urbana. Coordinated Science Lab.
EFFECTS OF REDUNDANCY ON FAULT DETECTION AND DIAGNOSIS IN COMBINATIONAL LOGIC CIRCUITS
Howard Warren Pribble Sep. 1974 136 p refs
(Contract DAAB07-72-C-0259)
(AD-787463; R-657) Avail: NTIS CSCL 09/2

The effect of undetectable faults on fault detection and diagnosis is studied. Methods such as judicious selection of a test set and use of additional circuit imputs are formulated for minimizing any adverse effects of redundancy. A computer program is developed which will simulate any combinational logic circuit for the purpose of logic verification and to determine fault detectibility. Second generation faults are calculated by a subroutine called upon by the program if any redundancy is discovered in the circuits. J.M.S.

N75-15895# IIT Research Inst., Chicago, Ill.
EMP PREFERRED TEST PROCEDURES (SELECTED ELECTRONIC PARTS)
J. E. Bridges and W. C. Emberson 29 Aug. 1974 179 p refs
(Contract DNA001-72-C-0089)
(AD-787482; DNA-3286H) Avail: NTIS CSCL 09/3

Recommended EMP Test Procedures are provided to evaluate or characterize the performance of filters or surge arrestors. Areas covered in detail are experiment design, documentation, representative EMP induced transients, and test procedures to evaluate the EMP behavior of surge arrestors and filters. Author (GRA)

N75-15896# Naval Electronics Lab. Center, San Diego, Calif.
MILLIMETER WAVE GUNN AMPLIFIER, DIODE CHARACTERIZATION AND NETWORK OPTIMIZATION Technical Document, 1 Jan. - 1 Jul. 1974
D. Rubin Aug. 1974 46 p refs
(NELC Proj. Z193; ZR0000101)
(AD-787468; NELC-TD-340) Avail: NTIS CSCL 09/5

Under a previous task the Logistics Management Institute (LMI) developed a conceptual model for the Air Force which allows military essentiality considerations to be reflected in budgets and procurement plans for recoverable (repairable) aircraft components. Using the model, spares can be procured so that the number or percentage of operational units of the different weapon systems tend to be in the best balance obtainable under any or all procurement funding constraints. The report describes tests by which the LMI model was compared with a marginal analysis requirements determination model planned by the Air Force for their evolving Advanced Logistics System. Tests showed that solutions from the LMI model are optimal, considering the mathematical assumptions common to the two models, and that solutions from the currently planned model are not. (Modified author abstract) GRA

N75-15897# Cornell Univ., Ithaca, N.Y.
CURRENT-PHASE RELATIONS AND NOISE IN RF BIASED SQUIDS
L. D. Jackel, T. D. Clark, and R. A. Buhrman 1 Oct. 1974 6 p refs Presented at Appl. Superconductivity Conf. Oakbrook, Ill., Oct. 1974
(Contract N00014-67-A-0077-0016; NR Proj. 319-032)
(AD-787110; MSC-2316; TR-22) Avail: NTIS CSCL 09/1

An investigation was made of the effect of the weak link current-phase relations on noise in rf biased SQUIDs. Non-sinusoidal current-phase relations have been observed in various weak links and these non-sinusoidal relations have been correlated with significantly increased intrinsic noise in the SQUID ring. The current-phase relation is also found to affect the amplitude of the rf SQUID ring dissipation. The result of a rf SQUID system noise analysis shows that, due to increased intrinsic noise and reduced ring dissipation, the minimum attainable noise for a SQUID ring having a very non-sinusoidal current-phase relation is considerably greater than for a ring with a sinusoidal relation. Author (GRA)

N75-15898# Army Electronics Command, Fort Monmouth, N.J.
MULTITONE SIGNAL STUDY Technical Report, May - Jul. 1974
Mortimer H. Zinn Oct. 1974 28 p ref
(DA Proj. 1S7-62705-AH-94B)
(AD-787358; ECOM-4265) Avail: NTIS CSCL 09/5

When an amplifier is used to amplify a number of carriers at different frequencies with or without amplitude modulation, the envelope of the sum of the different signals can cover a wide range of voltage or input power. This wide range of amplitude results in both inefficient operation and high intermodulation products when conventional amplifiers are used. It is proposed to improve both the efficiency and linearity by using the envelope of the input signal to modulate the instantaneous input power to the device. In order to maximize the efficiency, it is shown that fixed delays in each signal circuit before addition can be used to minimize the voltage range for any given number of signals at either random frequencies or at specifically allocated channel frequencies. Author (GRA)

N75-15899# Texas Technological Univ., Lubbock. Dept. of Electrical Engineering.
ELECTROMECHANICAL PULSAR INVESTIGATION Final Report, 1 Mar. - 28 Feb. 1974
J. P. Craig, M. O. Hagler, and K. I. Selin Sep. 1974 159 p refs
(Contract F30602-73-C-0170; AF Proj. 4506)
(AD-787674; A-002-RADC-1-74; RADC-TR-74-227) Avail: NTIS CSCL 14/2

The report concerns a feasibility study of electromechanical pulsers for the production of short duration, high power pulses with a low duty cycle. The pulse repetition rate is 0.200 pps. The output pulses are 40 kV, 1kA into a 40 ohm resistive load, with pulse duration between 20 and 40 us and with rise and fall times of 3 us or less. Several different approaches have been considered in an attempt to meet the requirements, including variable capacitance, variable reluctance, piezoelectric and electromagnetic generators with and without cryogenic fields. It was found that it is feasible to use an electromechanical pulser with some recommended switching schemes to meet the required pulse shape. Without switching, rise times approximately 13 us and fall times approximately 10 us are feasible. For some applications, a major advantage of an electromechanical pulser over conventional pulse methods is that high repetition rate bursts for short periods of time can be obtained. (Modified author abstract) GRA

N75-16245 Advisory Group for Aerospace Research and Development, Paris (France).
NOVEL DEVICES AND TECHNIQUES
E. Keonjian *In its* Principles of Avionics Computer Systems Dec. 1974 p 150-162 refs (For availability see N75-16236 07-59)

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N75-15900*# Brown Univ., Providence, R.I. Div. of Engineering.
ON THE DEVELOPMENT OF NOISE-PRODUCING LARGE-SCALE WAVELIKE EDDIES IN A TURBULENT JET
Lee-Or Merkine and J. T. C. Liu [1974] 34 p refs
(Grants NsG-1076; NSF GK-10008)
(NASA-CR-141323) Avail: NTIS HC $3.75 CSCL 20D

The development of large-scale wavelike eddies in a two-dimensional turbulent jet was studied. The basic mean flow develops from a mixing region type with an initial specified boundary layer thickness into a fully developed jet. The role of the varicose and sinuous modes as these develop in a growing mean flow is brought out. In general, it was found, for a given frequency parameter, the varicose mode has a shorter streamwise lifetime than the sinuous mode. The latter, for lower frequency ranges, persists past the end of the potential core only to be subject to dissolution by the more enhanced fine scale turbulent activity in that region. Author

N75-15901*# New York Univ., N.Y. Aerospace Lab.
A NEW TECHNIQUE FOR INDUCING A TURBULENT BOUNDARY LAYER IN A SUPERSONIC FLOW
Masafum Miyazawa [1974] 50 p refs
(Grant NGR-33-016-131)
(NASA-CR-132554) Avail: NTIS HC $3.75 CSCL 20D

The feasibility of using slot injection to establish a turbulent boundary layer corresponding to a known Reynolds number was investigated. The basic concept consists of injecting secondary air through a slot. The air is injected at the same local static pressure at a selected stagnation temperature to simulate a given up-stream heat conduction. The mass of the injected air is controlled to match a desired Reynolds number. Secondary air was injected through a supersonic nozzle over a flat plate model. Tests were conducted with different injection air conditions. Heat transfer rates were measured behind the slot and results were compared with theoretical estimates. Static pressure measurements were made over the surface in the streamwise direction. Velocity and Mach number profiles were determined downstream of the slot. Laminar and turbulent profiles were calculated to compare with the results of measurements. Experimental results indicate that this is an effective method for establishing a turbulent boundary layer having a prescribed value of R sub e Theta. Author

N75-15902*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AN IMPROVED HEAT TRANSFER DEVICE Patent Application
Larry R. Eaton, inventor (to NASA) (McDonnell Douglas Astron. Co., Huntington Beach, Calif.) Filed 21 Jan. 1975 15 p Sponsored by NASA
(NASA-Case-MFS-22938-1; US-Patent-Appl-SN-542754) Avail: NTIS HC $3.25 CSCL 20D

A heat transfer device has been developed that is particularly suited for use as an evaporator plate in a diffusion cloud chamber. NASA

N75-15903*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
METHOD OF PREDICTING RADIATION HEAT TRANSFER IN TURBINE COOLING TEST FACILITIES
Herbert J. Gladden and Curt H. Liebert Washington Jan. 1975 21 p refs
(NASA-TM-X-3172; E-8110) Avail: NTIS HC $3.25 CSCL 20M

A method is presented for calculating the average net radiation heat flux to turbine vanes and blades. The net radiation heat flux at a vane leading edge calculated by this method was compared with heat flux values independently determined from

experimental tests on a vane in a cascade. The spectral emissivities of the turbine vane and the cascade wall were also measured.
Author

N75-15904*# Beckman Instruments, Inc., Anaheim, Calif. Advanced Technology Operations.
FLUID INFUSION SYSTEM
17 Dec. 1974 15 p
(Contract NAS9-14080)
(NASA-CR-141565; ATP-1185-501) Avail: NTIS HC $3.25 CSCL 20D

Performance testing carried out in the development of the prototype zero-g fluid infusion system is described and summarized. Engineering tests were performed in the course of development, both on the original breadboard device and on the prototype system. This testing was aimed at establishing baseline system performance parameters and facilitating improvements. Acceptance testing was then performed on the prototype system to verify functional performance. Acceptance testing included a demonstration of the fluid infusion system on a laboratory animal.
Author

N75-15905*# Princeton Univ., N.J. Guggenheim Labs. for the Aerospace Propulsion Sciences.
HIGH SPEED HYDROGEN/GRAPHITE INTERACTION Final Technical Report
A. J. Kelly, R. Hamman, O. P. Sharma, and D. T. Harrje May 1974 68 p refs
(Grant NGR-31-001-230)
(NASA-CR-142060; AMS-1206) Avail: NTIS HC $4.25 CSCL 20D

Various aspects of a research program on high speed hydrogen/graphite interaction are presented. Major areas discussed are: (1) theoretical predictions of hydrogen/graphite erosion rates; (2) high temperature, nonequilibrium hydrogen flow in a nozzle; and (3) molecular beam studies of hydrogen/graphite erosion.
J.M.S.

N75-15906*# Michigan State Univ., East Lansing. Div. of Engineering Research.
DEVELOPMENTS IN THE LARGE ANGLE OBLIQUE JET IMPINGEMENT FLOW INVESTIGATION
John F. Foss 12 Feb. 1975 19 p refs
(Grant NGR-23-004-091)
(NASA-CR-142069) Avail: NTIS HC $3.25 CSCL 20D

Single-wire (hot-wire) measurements are presented of the mean velocity and turbulence quantities near the impact plate for a 45-degree impingement flow responsible for acoustic noise production. These results are summarized along with the conclusions which shaped the subsequent direction of the study of large angle oblique jet impingement flow. The development of a unique signal processing circuit for finding the instantaneous transverse vorticity from an array of four hot-wires is discussed.
M.J.S.

N75-15907*# Propulsion Sciences, Inc., Melville, N.Y.
VAPORIZATION RESPONSE OF EVAPORATING DROPS WITH FINITE THERMAL CONDUCTIVITY Final Report
V. D. Agosta and S. S. Hammer Washington NASA Jan. 1975 59 p refs
(Contract NAS3-16761)
(NASA-CR-2510) Avail: NTIS HC $4.25 CSCL 20E

A numerical computing procedure was developed for calculating vaporization histories of evaporating drops in a combustor in which travelling transverse oscillations occurred. The liquid drop was assumed to have a finite thermal conductivity. The system of equations was solved by using a finite difference method programmed for solution on a high speed digital computer. Oscillations in the ratio of vaporization of an array of repetitivity injected drops in the combustor were obtained from summation of individual drop histories. A nonlinear in-phase frequency response factor for the entire vaporization process to oscillations in pressure was evaluated. A nonlinear out-of-phase response factor, in-phase and out-of-phase harmonic response factors, and a Princeton type 'n' and 'tau' were determined. The resulting data was correlated and is presented in graphical format. Qualitative agreement with the open literature is obtained in the behavior of the in-phase response factor. Quantitatively the results of the present finite conductivity spray analysis do not correlate with the results of a single drop model.
Author

N75-15908*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SHOCK SHAPES ON BLUNT BODIES IN HYPERSONIC-HYPERVELOCITY HELIUM, AIR, AND CO2 FLOWS, AND CALIBRATION RESULTS IN LANGLEY 6-INCH EXPANSION TUBE
Charles G. Miller, III Washington Feb. 1975 86 p refs
(NASA-TN-D-7800; L-9775) Avail: NTIS HC $4.75 CSCL 20D

Shock shape results for flat-faced cylinders, spheres, and spherically blunted cones in various test gases, along with preliminary results from a calibration study performed in the Langley 6-inch expansion tube are presented. Free-stream velocities from 5 to 7 km/sec are generated at hypersonic conditions with helium, air, and CO2, resulting in normal shock density ratios from 4 to 19. Ideal-gas shock shape predictions, in which an effective ratio of specific heats is used as input, are compared with the measured results. The effect of model diameter is examined to provide insight to the thermochemical state of the flow in the shock layer. The regime for which equilibrium exists in the shock layer for the present air and CO2 test conditions is defined. Test core flow quality, test repeatability, and comparison of measured and predicted expansion-tube flow quantities are discussed.
Author

N75-15909# Technische Universitaet, Munich (West Germany).
IMPORTANCE OF VARIATIONAL CALCULUS IN FLUID MECHANICS AND ITS APPLICATION TO COMPRESSIBLE POTENTIAL FLOWS Ph.D. Thesis [BEDEUTUNG DER VARIATIONSRECHNUNG IN DER STROEMUNGSMECHANIK UND IHRE ANWENDUNG BEI KOMPRESSIBLEN POTENTIALSTROEMUNGEN]
Peter Berndt 26 Jul. 1973 27 p refs In GERMAN
Avail: NTIS HC $3.75

The finite element method is used to develop a procedure for calculating the compressible, nonlinear potential fluid flow around a lifting wing profile at subsonic speed.
Transl. by G.G.

N75-15910# Los Alamos Scientific Lab., N.Mex.
STOCHASTIC/ANALOG SIMULATOR FOR VISCOUS, INCOMPRESSIBLE FLUID FLOW
J. P. Shipley Mar. 1974 12 p refs
(Contract W-7405-eng-36)
(LA-5584) Avail: NTIS HC $3.25

A restricted form of the simplified marker-and-cell (SMAC) algorithm for calculating incompressible fluid flows is described. The SMAC algorithm is suitable for hardware implementation. The necessary hardware for building a simulator is discussed in terms of block diagrams and cell circuitry. Such a simulator is feasible if stochastic processing techniques are used. Some cost estimates are given.
Author (NSA)

N75-15911# Purdue Univ., Lafayette, Ind. Engineering Experiment Station.
TURBULENT DIFFUSION IN LIQUID JETS, PART 1 Ecological Research Series
Charles H. Tinsley, Warren S. Stevenson, and Victor W. Goldschmidt Mar. 1974 79 p refs Sponsored by EPA
(PB-234170/9; W74-10196; EPA-660/3-74.004a) Avail: NTIS MF $2.25; SOD HC $1.15 CSCL 20D

A technique for measuring particle concentrations in turbulent flows was investigated. This technique is the measurement of the light scattering from an incident beam by the solid contaminants present. The results show that for moderate concentrations the scattering system gives proportional increases in count to increases in particle concentration. The limitations of this system are the signal to noise ratio and the condition of singular scattering by the particles. Suggestions on refinements on the correlation technique used are made and observed phenomena which require further investigation are discussed.
GRA

N75-15912# Purdue Univ., Lafayette, Ind. Engineering Experiment Station.
TURBULENT DIFFUSION IN LIQUID JETS Final Report
Strong C. Chaung and Victor W. Goldschmidt Mar. 1974

131 p refs Sponsored by EPA
(PB-234171/7; W74-10195; EPA-660/3-74-004b) Avail: NTIS MF $2.25; SOD HC $1.70 CSCL 20D

Laboratory studies were conducted on the dispersion of gas driplets of different sizes in turbulent water jets. The main purpose was to determine the turbulent transport coefficient of contaminants suspended in turbulent flows. The experimental results were compared to measurements of diffusion of liquid droplets in air jets as well as to a numerical analysis based on the equations of the particles themselves. Small particles in turbulent flows are seen to have an increasing turbulent transport coefficient with size. GRA

N75-15913# Army Missile Command, Redstone Arsenal, Ala. Aeroballistics Directorate.
COMPRESSIBLE FLOW SOLUTIONS IN TWO SPACE VARIABLES USING A SUCESSIVE PERTURBATION METHOD
B. Z. Jenkins 22 Jul. 1974 25 p
(AD-787272; RD-75-1) Avail: NTIS CSCL 20/4

The present work is the result of a study of the Spalding-Patankar pressure linked algorithm treated as a perturbation technique. The ease of use and demonstrated convergence of the method indicate that its extension or generalization might be fruitful in producing new relaxation procedures. This report describes the application of a relaxation method modeled on the pressure linked algorithm to two dimensional compressible flow. GRA

N75-15914# Naval Postgraduate School, Monterey, Calif.
PERIODIC FLOW ABOUT BLUFF BODIES. PART 1: FORCES ON CYLINDERS AND SPHERES IN A SINUSOIDALLY OSCILLATING FLUID Technical Report, Sep. 1973 - 1974
Turgut Sarpkaya and Olcay Tuter Sep. 1974 90 p refs Sponsored by NSF
(AD-785853; NPS-59SL74091) Avail: NTIS CSCL 20/4

The in-line and transverse forces acting on cylinders and the in-line force acting on spheres placed in a sinusoidally oscillating fluid have been measured. The periodic flow was generated in a U-shaped vertical water channel through the use of a pneumatic oscillator. The drag, inertia and the lift coefficients as well as the total force coefficient have been determined through the use of Fourier analysis and found to depend on a period parameter. (Modified author abstract) GRA

N75-15915# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.
THREE STAGE IMPACT PROCESS IN LIQUID IMPINGEMENT
Yen C. Huang Sep. 1974 28 p refs Sponsored by NSF Prepared in cooperation with Combustion Engineering, Inc., Windsor, Conn.
(PB-236235/8; UMICH-01357-28-1) Avail: NTIS HC $3.75 CSCL 20D

A liquid impingement, jet or drop, produces a very high destructive stress on the area of impact. The three-stage-impact-process uncovers a theory, supported by experimental evidences, to explain the variation of amplitudes and locations of the initial, momentary impact pressures. The theory also clears the puzzling discrepancy between analytical critical angle and experimental data. GRA

N75-15916# Illinois Univ., Urbana. Dept. of Computer Science.
TRANSIENT VISCOUS FLOW AROUND AN ELLIPTIC CYLINDER M.S. Thesis
Gary Arthur Roediger Jul. 1974 52 p refs
(PB-235998/2; UIUCDCS-R-74-670) Avail: NTIS HC $4.25 CSCL 20D

The paper presents a study of the transient flow of a compressible viscous gas around an elliptic cylinder which smoothly accelerates to a fixed velocity. The complete time-dependent Navier-Stokes equations are solved numerically in the body reference frame using a non-orthogonal time-dependent curvilinear coordinate system designed to describe the body exactly and to resolve the important features of the transient flow. The computation is performed in a fixed mesh which maps into a grid in physical space which evolves to accommodate the transient flow. GRA

N75-15917# Office of Naval Research, London (England).
MECHANICS AND FLUID MECHANICS AT DELFT
H. G. Elrod 23 Sep. 1974 12 p refs
(AD-787628; ONRL-R-7-74) Avail: NTIS CSCL 20/4

This report summarizes the research activities of some prominent Delft professors involved in lubrication, jet mixing, turbulence, rheology and aeronautics. Author (GRA)

N75-15918# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
RESEARCH ON BOUNDARY-LAYER SEPARATION Final Report, 1 Mar. 1966 - 31 Aug. 1974
R. C. Ackerberg 20 Sep. 1974 9 p refs
(Contract DA-31-124-ARO(D)-444; Grants DA-ARO(D)-31-124-71-G68; DA-ARO(D)-31-124-73-G91)
(AD-787528; POLY-AE/AM-74-14; AROD-6152-21-E) Avail: NTIS CSCL 20/4

The study of the laminar boundary-layer flow and separation from a wall just upstream of a sharp trailing edge at which a free streamline is attached is discussed and summarized. A new method for integrating the unsteady laminar boundary-layer equations when there are regions of backflow is described. A complete set of references to this work is included. Author (GRA)

N75-15919# Harry Diamond Labs., Washington, D.C.
PROCEEDINGS OF THE FLUIDIC STATE-OF-THE ART SYMPOSIUM, VOLUME 1
1974 606 p refs Presented at the Fluidic State-of-the-Art Symp., White Oak, Md., 30 Sep. - 3 Oct. 1974
(HDL Proj. 302531)
(AD-787546) Avail: NTIS CSCL 13/7

Contents: Fluerics; fluidics; vortex diode; vortex triode; turbulence amplifier; laminar proportional amplifier; wall-attachment fluid amplifiers; and bistable fluidic amplifiers. GRA

N75-15920# Harry Diamond Labs., Washington, D.C.
PROCEEDINGS OF THE FLUIDIC STATE-OF-THE-ART SYMPOSIUM, VOLUME 4
1974 390 p refs Symp. held at White Oak, Md. 30 Sep. 3 Oct. 1974
(HDL Proj. 302531)
(AD-787549) Avail: NTIS CSCL 13/7

Contents: Computer aided fluidic circuit design; fluidic compensation networks; fluidic multiplier; fluidic impedance measurement; fluidic interconnections; pneumatic transmission lines; Sixth Cranfield Fluidics Conference; and fluidics stabilization contamination effects on fluidic devices. GRA

N75-15921# Harry Diamond Labs., Washington, D.C.
PROCEEDINGS OF THE FLUIDIC STATE-OF-THE-ART SYMPOSIUM, VOLUME 5
1974 515 p refs Symp. held at White Oak, Md., 30 Sep. - 3 Oct. 1974
(HDL Proj. 302531)
(AD-787550) Avail: NTIS CSCL 13/7

Contents: Fluidics fabrication; fluidic products; fluidic industrial process applications; fluidic cooling controls; hydraulic control systems; fluidic fuel controls; fluidic ejection seat control; fluidic brake control; fluidic anti-skid systems; fluidic bag manufacturing control; fluidic military applications; fluidic oil-water separator; fluidic bistable actuator; fluidic missile control valve; and flow control circuits. GRA

N75-15922# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
THE ELIMINATION OR CONTROL OF MATERIAL PROBLEMS IN WATER HEAT PIPES Semiannual Progress Report, 1 Jan. - 30 Jun. 1974
G. F. Pittinato 31 Jul. 1974 29 p
(Grant NSF GI-41310)
(PB-235482/7; MDC-G5481-A; NSF/RANN/SE/GI-41310/PR/74/2; NSF/RA/N-74-066) Avail: NTIS HC $3.75 CSCL 13A

Several different concepts for using solar energy involve the

use of heat pipes to transport energy within the systems. Two 347 SS water heat pipes measuring 86.5 cm long were fabricated with one of the pipes containing a 200 mesh 347 SS screen wick. Fourteen additional heat pipes measuring 76 cm long were also fabricated, two from each of the following materials: 347 SS, 316 SS, 430 SS, Monel 400, Inconel 600, Incoloy 800, and CDA 715. Except for the 430 SS, a cleaning procedure was established for removing the oxide formed during welding. The furnaces and temperature control and monitoring equipment have been installed and the heat pipes are presently being instrumented. All of the heat pipes will be tested. (Modified author abstract) GRA

N75-15923# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
ON THE BEHAVIOR OF TURBULENT BOUNDARY LAYERS NEAR THE POINT OF ZERO WALL SHEAR Interim Report
D. Th. Tsahalis and D. P. Telionis Aug. 1974 55 p refs
(Grant AF-AFOSR-2651-74; AF Proj. 9781)
(AD-787714; VPI-E-74-20) Avail: NTIS CSCL 20/4

The turbulent boundary layer equations are integrated numerically in their differential form. The eddy viscosity model with a mixing length as refined by Van Driest and Cebeci is used. Results are checked against experimental data and accuracy is compared with predictions of similar methods. The flow is examined carefully in the neighborhood of the point of zero skin friction. It is found that this point is a singular point accompanied by all the familiar properties of the Goldstein singularity.
Author (GRA)

N75-15924# Harry Diamond Labs., Washington, D.C.
PROCEEDINGS OF THE FLUIDIC STATE-OF-THE-ART SYMPOSIUM, VOLUME 2
1974 643 p refs Symp. held at Naval Ordnance Lab., White Oak, Md., 30 Sep. - 3 Oct. 1974
(HDL Proj. 302531)
(AD-787547) Avail: NTIS CSCL 13/7

Contents: Fluidics; fluerics; miniature fluid amplifier; bistable fluid amplifier; laminar flip-flop; moving part fluidic devices; fluidic pressure-flow interface; fluidic sensors; fluidic acoustic sensor; vortex rate sensor; laminar jet rate sensor; fluidic G sensor; pneumatic rate/acceleration sensor; fluidic non-contact gaging; rotational speed control; fluid amplifier scaling; heat and mass transfer in fluidic circuits; thrust of free and submerged jets; particles in fluidic devices; and supersonic boundary layer. GRA

N75-15925# Colorado State Univ., Fort Collins. Fluid Dynamics and Diffusion Lab.
THREE-DIMENSIONAL TURBULENT BOUNDARY LAYER FLOW ON ROUGHNESS STRIP OF FINITE WIDTH
Walter H. Edling and J. E. Cermak Apr. 1974 261 p refs
(Contract N00014-68-A-0493-0001; NR Proj. 062-414)
(AD-787584; CER73-74WHE-JEC34; THEMIS-CER-TR-27) Avail: NTIS CSCL 20/4

Described are the results of an experimental study of a well developed, turbulent boundary layer on a smooth, flat surface encountering an area of much rougher surface. The roughened area is a strip with its length extending in the direction of the mean flow but of finite width in the surface direction normal to the flow. The resulting three-dimensional flow is found to differ significantly from previously studied cases involving step changes in roughness of infinite extent in the direction normal to the flow. Extensive experiments are reported in a wind tunnel having a length of nearly 100 ft with a boundary layer thickness of the order of 18-20 in. Pitot tube and hot-wire anemometer measurements were made of mean velocity and Reynolds stress quantities throughout the flow field. Secondary flow components were measured by a new x-wire technique. (Modified author abstract) GRA

N75-15926# Naval Postgraduate School, Monterey, Calif.
HEAT TRANSFER CHARACTERISTICS OF ROTATING TWO-PHASE THERMOSYPHON M.S. Thesis
Richard Steven Tucker Sep. 1974 57 p refs
(AD-787449) Avail: NTIS CSCL 13/1

A rotating two-phase thermosyphon fitted with a copper condenser section was tested at 700, 1400 and 2800 RPM using water, ethanol and freon 113 as working fluids. Both experimental and theoretical heat transfer rates were determined. Agreement between theory and experiment was good at low rotational speeds and improved as the rotational speed increased. (Modified author abstract) GRA

N75-15927# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN EXPERIMENTAL INVESTIGATION OF OPEN CAVITY PRESSURE OSCILLATIONS M.S. Thesis
Dennis L. Carr Sep. 1974 74 p refs
(AD-787700; GAE/AE/74S-1) Avail: NTIS CSCL 20/4

An experimental study was undertaken to investigate the use of a water table to define the parameters that influence the pressure oscillations resulting from air flow over open cavities. Tests were also conducted to investigate means to eliminate or reduce these oscillations. Author (GRA)

N75-15928# Army Foreign Science and Technology Center, Charlottesville, Va.
DESIGNING PROCESS PARAMETER TRANSDUCERS USING FLUIDIC ELEMENTS
G. G. Molchanov, A. P. Popov, and E. K. Shchepin 1 Apr. 1974 22 p refs Translated into ENGLISH from unidentified Russian Mono. paper B-16, 14 p. Presented at 4th Intern. Fluidics Conf., Varna, Bulgaria, 14-18 Oct. 1972
(AD-783738; FSTC-HT-23-1642-73; Paper-B-16) Avail: NTIS CSCL 13/7

Hydraulic transducers measuring certain standard process parameters are discussed, incorporating impact modulators. Schemes of compensation-type transducers are presented; transfer functions are derived; and the results of experimental studies of static and dynamic characteristics are included. GRA

N75-15929# Connecticut Univ., Storrs. Inst. of Water Resources.
COMBINED BUOYANCY AND BOUNDARY EFFECTS AND AERATION EFFECTS ON JET SPREADING
E. K. Dabora and R. L. Stoy Aug. 1974 6 p
(Contract DI-14-31-0001-3507)
(PB-236790/2; W75-00265) Avail: NTIS HC $3.25 CSCL 20D

The effects of surface boundary, buoyancy and aeration on water jets were investigated both experimentally and analytically. For two-dimensional horizontally discharged jets with initial velocities up to 10 ft/sec., the flow field (trajectory and reattachment) point is dominated by the development of a forced vortex in the recirculativn region. The most dominant factor seems to be the submergence ratio based on the exit slot height. Aeration provides increased buoyancy and therefore affects the reattachment location. The two-dimensional jet arrangement is suitable for providing containment of a pool of heated water above the jet trajectory which can be advantageous for either increased heat dissipation to the atmosphere or aquaculture. For the axisymmetric jets, aeration resulted in a decrease in the spread of a vertically discharged jet and an increase in the temperature decay of its centerline. GRA

N75-15930# Air Force Academy, Colo. Frank J. Seiler Research Lab.
PNEUMATIC/HYDRAULIC TRANSMISSION LINE MODELS Scientific Report, May - Sep. 1974
Richard P. Braden Sep. 1974 71 p refs
(AF Proj. 7905)
(AD-787662; SRL-TR-74-0021) Avail: NTIS CSCL 13/7

The purpose of this report is to present a set of linearized, low frequency ordinary differential equation models for a fluid filled transmission line (perfect gas or liquid). The models include the effects of frequency dependent friction and large amplitude disturbances in the line. To drive the models, known solutions to the axial momentum equation in the Laplace domain are inverse transformed to the time domain by suitable approximations. GRA

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N75-15931* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LEAK DETECTOR Patent
James T. Sawyer, inventor (to NASA) Issued 14 Jan. 1975 5 p Filed 5 Mar. 1973 Supersedes N73-18444 (11 - 09, p 1035)
(NASA-Case-MFS-21761-1; US-Patent-3,859,845; US-Patent-Appl-SN-337816; US-Patent-Class-73-49.2; US-Patent-Class-73-40; US-Patent-Class-200-83N) Avail: US Patent Office CSCL 14B

A detector for sensing a leaking of fluid pressures is reported. The detector is characterized by an hermetically sealed housing confining therewithin a first normalized pressure, a connector for coupling the housing in direct communication with a suspected leak established within a substantially sealed body, an electrical circuit having a first or normalized configuration and including a pair of circuit completing electrical contacts and means mounting at least one contact of said pair of contacts on a flexible wall of the housing supporting the contact for movement from a first position along a linear path to a second position in response to an altering of the pressure confined within the housing for thereby altering the configuration of the circuit.
Official Gazette of the U.S. Patent Office

N75-15932* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ERGOMETER CALIBRATOR Patent
Raymond L. Gause, inventor (to NASA) Issued 14 Jan. 1975 5 p Filed 31 Oct. 1973 Supersedes N74-11288 (12 - 02, p 0169)
(NASA-Case-MFS-21045-1; US-Patent-3,859,840; US-Patent-Appl-SN-411572; US-Patent-Class-73-1R; US-Patent-Class-73-379) Avail: US Patent Office CSCL 14B

An apparatus is presented for accurately calibrating ergometers so that the work rate produced by the particular ergometer being calibrated is accurate. The apparatus includes a dc motor which is coupled directly to the ergometer for rotating it at various speeds. Positioned on the shaft between the dc motor and the ergometer is a torque sensor and tachometer, which feed signals to a power computer for subsequent recording. A speed controller is utilized with the dc motor.
Official Gazette of the U.S. Patent Office

N75-15933*# Technicolor Graphic Services, Inc., Houston, Tex.
COMPARISON OF MX-857 VERSUS MX-641 CHEMISTRIES FOR TYPE 2485 FILM
Paul F. Bourque 3 May 1972 17 p
(Contract NAS9-11500)
(NASA-CR-141491; TR-72-2) Avail: NTIS HC $3.25 CSCL 14E

Tests were conducted to evaluate Kodak MX-857 and MX-641 chemistry systems for use with film Type 2485 to be used in the dim light experiments on Apollo 16. The test program objectives were to: (1) retain a minimum ASA speed of at least 4000; (2) maintain a base-plus-fog level of 0.21 density units or less; and (3) minimize the granularity but do not exceed the granularity level of the Apollo 15 imagery. Test results on the Versamat processor indicate that the use of MX-857 chemistry is preferred over MX-641 chemistry in satisfying the stated test objectives. Author

N75-15934*# Technicolor Graphic Services, Inc., Houston, Tex.
FILM HANDLING PROCEDURES FOR SKYLAB S-056 EXPERIMENT
Keith A. Maas Sep. 1972 14 p
(Contract NAS9-11500)
(NASA-CR-141487; TN-72-12) Avail: NTIS HC $3.25 CSCL 14E

In a simulation conducted August 28, 1972, two rolls of Type SO-212 film were rewound in the sensitometer darkroom preparatory to processing. The first roll contained approximately 500 feet of film exposed to a resolution target and was unloaded from a can. The second roll of 1000 feet, with about 600 feet advanced to the takeup side, was in a flight magazine. The downloading and rewinding of this second roll of film is described in detail. Author

N75-15935*# Technicolor Graphic Services, Inc., Houston, Tex.
EVALUATION OF AGFACONTOUR PROFESSIONAL FILM
Robert A. Goodo ng [1972] 12 p
(Contract NAS9-11500)
(NASA-CR-141500; TN-72-3) Avail: NTIS HC $3.25 CSCL 14B

The results obtained by the Photo Science Office in the evaluation of Agfacontour Professional Film are presented. The feasibility of utilizing this film in the evaluation of aerial or extraterrestrial imagery has been investigated. Sensitometric properties have been determined, and optimum handling techniques have been identified in an attempt to facilitate better use of the material. Author

N75-15936*# Technicolor Graphic Services, Inc., Houston, Tex.
PROTECTIVE OVERCOATING OF FILMS
Keith A. Maas Jun. 1972 18 p ref
(Contract NAS9-11500)
(NASA-CR-141493; TR-72-4) Avail: NTIS HC $3.25 CSCL 14E

Kodak Film Type SO-212 was emulsion overcoated with gelatin and lacquer to evaluate the feasibility of application of the coatings, any image degradation, and the relative protection offered against abrasion. Evaluated were: Eastman motion picture film lacquer Type 485, water solutions of Eastman purified Calfskin gelatin, and experimental Eastman gelatin stripping film of 4 and 6 microns. Conclusions reached were: (1) All coatings can be applied with relative ease with the only limitation being that of equipment. (2) None of the coatings degrade the processed image. (3) All of the coatings provide protection to the emulsion. These conclusions apply to any film which may be considered for overcoating. Author

N75-15937*# Technicolor Graphic Services, Inc., Houston, Tex.
ANALYSIS OF DUPONT AND KODAK DUPLICATING FILMS AND CHEMISTRIES IN A FULTRON SPRAY PROCESSOR
Mark S. Weinstein Jul. 1972 99 p
(Contract NAS9-11500)
(NASA-CR-141495; TR-72-6) Avail: NTIS HC $4.75 CSCL 14E

A test program was conducted with duPont duplicating film type SR 112 and SCOLOR developer and Kodak duplicating film types 2430, 2422, and FE 2628 (SO-467) and MX-641 developer to determine sensitometric and image quality characteristics of these materials when used with a fultron spray processor. The test results show that the SCOLOR developer foams excessively in the fultron processor when used with or without the addition of an antifoaming agent. The Kodak type FE 2628 film with MX-641 chemistry had the longest linear Log E range at a 1.0 gamma. Sensitometric curves and granularity traces for all film process combinations tested are included. Author

N75-15938*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
METHOD FOR DETECTING POLLUTANTS Patent Application
Robert S. Rogowski, Ralph R. Richards (Old Dominion Univ.), and Edmund J. Conway, inventors (to NASA) Filed 30 Dec. 1974 14 p
(NASA-Case-LAR-11405-1; US-Patent-Appl-SN-537480) Avail: NTIS HC $3.25 CSCL 14B

A method is described for detecting and measuring trace amounts of pollutants of the group consisting of ozone, nitrogen dioxide, and carbon monoxide in a gaseous environment. A sample organic solid material that will undergo a chemical reaction with the test pollutant is exposed to the test environment and heated in the temperature range of 100-200 C. The chemiluminescence of the solid organic material is measured and recorded as a

function of concentration of the test pollution and is specific to the pollutant being tested. NASA

N75-15939*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
A HIGH-INPUT IMPEDANCE DIFFERENTIAL MILLIVOLT METER FOR USE WITH SOLID CERAMIC OXYGEN ELECTROLYTE CELLS
Richard J. Williams, O. Mullins (Lockheed Electronics Co., Inc., Houston, Tex.), and E. Quin (Lockheed Electronics Co., Inc., Houston, Tex.) Jan. 1975 7 p
(NASA-TM-X-58150; JSC-09305) Avail: NTIS HC $3.25 CSCL 14B

Design factors are given for a high-input impedance differential millivolt meter designed, built, and tested as an inexpensive solid-state electronic system for use in measuring the electromotive force from solid ceramic oxygen electrolyte cells. A schematic diagram is included. Author

N75-15940*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PERFORMANCE AND EVALUATION OF THE VIKING LANDER CAMERA PERFORMANCE PREDICTION PROGRAM
Friedrich O. Huck, Edward J. Taylor, Daniel J. Jobson, and Carroll W. Rowland Jan. 1975 49 p refs
(NASA-TM-X-72646) Avail: NTIS HC $3.75 CSCL 14E

A computer program is described for predicting the performance of the Viking lander cameras. The predictions are primarily concerned with two objectives: (1) the picture quality of a reference test chart (of which there are three on each lander) to aid in diagnosing camera performance; and (2) the picture quality of cones with surface properties of a natural terrain to aid in predicting favorable illumination and viewing geometries and operational camera commands. Predictions made with this program are verified by experimental data obtained with a Viking-like laboratory facsimile camera. Author

N75-15941*# Technicolor Graphic Services, Inc., Houston, Tex.
DETERMINATION OF FILM PROCESSING SPECIFICATIONS FOR THE APOLLO 17 S-209 LUNAR SOUNDER EXPERIMENT Interim Report
Mark S. Weinstein 17 Apr. 1972 19 p
(Contract NAS9-11500)
(NASA-CR-141551; TN-72-4) Avail: NTIS HC $3.25 CSCL 14E

The lunar sounder is described as a radar system operating at carrier frequencies of 5, 15, and 150 MHz. The radar echoes are recorded onto Kodak type SO-394 film through the use of an optical recorder utilizing a cathode ray tube as the exposing device. A processing configuration is determined with regard to linearity, dynamic range, and noise. M.C.F.

N75-15942*# Technicolor Graphic Services, Inc., Houston, Tex.
FILM TYPE SO-168 RADIATION STUDY
W. Norman Pierce Jan. 1972 21 p
(Contract NAS9-11500)
(NASA-CR-141554; TN-72-2) Avail: NTIS HC $3.25 CSCL 14E

Investigations were performed to determine optimum exposure and processing procedures necessary to partially offset the effect of radiation to which film type SO-168 will be exposed during the Skylab Mission. This task became necessary when it was determined that original predictions of 2 to 3 RADS of radiation to which the film will be exposed were too low, and that levels as high as 3.5 to 4.0 RADS may be incurred, thus reducing image quality below an acceptable level. Tests results show that forced processing of type SO-168 film tended to reduce the density range to an unusable level, and that processing to a lower ASA value would provide greater image quality for the user. Author

N75-15943*# Technicolor Graphic Services, Inc., Houston, Tex.
SPECIAL PROCESSING OF APOLLO 16 PAN CAMERA FILM
Mark S. Weinstein 5 May 1972 18 p
(Contract NAS9-11500)
(NASA-CR-141552; TN-72-5) Avail: NTIS HC $3.25 CSCL 07B

Due to the exposure conditions of the Apollo 16 Pan Camera imagery, a series of tests were run to determine if it was possible to: (1) maintain toe speed to preserve the normally exposed near-terminator imagery, and (2) retain an acceptable density range for the two stop overexposed portion of the imagery. A set of processing conditions (80 F, 15 fpm) was found which provide a significant improvement over the Standard Apollo 16 Control for Film Type 3414 in meeting the requirements. Author

N75-15944*# Technicolor Graphic Services, Inc., Houston, Tex.
APOLLO 16 PHOTOGRAPHIC STANDARDS DOCUMENTATION
Paul F. Bourque Jun. 1972 51 p
(Contract NAS9-11500)
(NASA-CR-141492; TR-72-3) Avail: NTIS HC $4.25 CSCL 14E

The activities of the Photographic Technology Division, and particularly the Photo Science Office, the Precision Processing Laboratory, and the Motion Picture Laboratory, in connection with the scientific photography of the Apollo 16 manned space mission are documented. Described are the preflight activities involved in establishing a standard process for each of the flight films, the manned in which flight films were handled upon arrival at the Manned Spacecraft Center in Houston, Texas, and how the flight films were processed and duplicated. The tone reproduction method of duplication is described. The specific sensitometric and chemical process controls are not included. Author

N75-15945*# Technicolor, Inc., Houston, Tex.
KODAK FILM TYPE SO-394-4-1 MOTTLING AND HYPERSENSITIZATION TEST
Mark S. Weinstein Sep. 1972 18 p
(Contract NAS9-11500)
(NASA-CR-141486; TN-72-11) Avail: NTIS HC $3.25

A number of tests were conducted to show the effects of various environmental conditions in terms of mottling and hypersensitization on Kodak Film type SO-394-4-1. The first two weeks of environmental testing is described, along with the test plan and matrix. Author

N75-15946*# Technicolor, Inc., Houston, Tex.
FEASIBILITY OF USING EASTMAN KODAK TYPE 3400 FILM FOR HIGH ALTITUDE MULTISPECTRAL PHOTOGRAPHY
Lincoln Perry Aug. 1972 10 p
(Contract NAS9-11500)
(NASA-CR-141485; TN-72-10) Avail: NTIS HC $3.25 CSCL 14E

A photographic test flight of the NASA RB-57F was conducted on March 25, 1972, over Houston and West Texas, to determine the suitability of Eastman Kodak type 3400 film as a replacement for type 2402 film in the Hasselblad cameras. An additional purpose was to test GAF film type 2914, a new black and white film similar to 2402, but with higher maximum gamma and greater dynamic range. Author

N75-15947*# Technicolor, Inc., Houston, Tex.
SEPARATION NEGATIVES FROM KODAK FILM TYPES SO-368 AND SO-242 Interim Technical Report
Mark S. Weinstein 17 May 1972 23 p
(Contract NAS9-11500)
(NASA-CR-141553; TN-72-6) Avail: NTIS HC $3.25 CSCL 14E

Two master resolution friskets were produced on Kodak film types SO-368 and SO-242. These target masters consisted of 21 density steps with three-bar resolution targets at five modulation levels within each step. The target masters were contact printed onto Kodak separation negative film, type 4131, using both a contact printing frame and enlarger as one method of exposure, and a Miller-Holzwarth contact printer as the other exposing device. Red, green, and blue Wratten filters were used to filter the exposing source. Tray processing was done with DK-50 developer diluted 1:2 at a temperature of 70 F. The resolution values were read for the SO-368 and SO-242 target

masters, and the red, green, and blue separation negatives.
Author

N75-15948*# Technicolor, Inc., Houston, Tex.
SENSITOMETRIC DATA FOR EARTH RESOURCES FILM
Lincoln Perry 1972 7 p
(Contract NAS9-11500)
(NASA-CR-141555; TN-72-2) Avail: NTIS HC $3.25 CSCL 14E

Sensitometry is applied to all photographic earth resources mission film processing. The exposure is made using an intensity modulated sensitometer with a 2850 K source filtered to produce a 5500 K spectral distribution. In addition, any filters used on the sensor are included in the sensitometer filter pack in order to accurately simulate the exposure conditions. The modulator consists of a continuous carbon wedge and a 20-step carbon step tablet.
Author

N75-15949*# Technicolor, Inc., Houston, Tex.
REVIEW OF MACHINE WASHING EFFICIENCY FOR ORIGINAL FILM
Keith A. Maas 6 Feb. 1975 21 p refs
(Contract NAS9-11500)
(NASA-CR-141488; TN-72-13) Avail: NTIS HC $3.25 CSCL 14E

Further silver sulfide stain tests for wash efficiency were conducted with major emphasis on means by which archival keeping quality may be achieved for original mission film.
Author

N75-15950*# Technicolor, Inc., Houston, Tex.
FILM PROCESSING INVESTIGATION
Jack L. Kelly Jun. 1972 70 p
(Contract NAS9-11500)
(NASA-CR-141494; TR-72-5) Avail: NTIS HC $4.25 CSCL 14E

The present operational chemical mixing system for the Photographic Technology Division is evaluated, and the limitations are defined in terms of meeting the present and programmed chemical supply and delivery requirements. A major redesign of the entire chemical mixing, storage, analysis, and supply system is recommended. Other requirements for immediate and future implementations are presented.
F.O.S.

N75-15951*# Technicolor, Inc., Houston, Tex.
IMPROVED DENSITY DISCRIMINATION USING AGFACONTOUR FILM
Robert A. Goodding Jan. 1973 21 p
(Contract NAS9-11500)
(NASA-CR-141489; TN-72-16) Avail: NTIS HC $3.25 CSCL 14E

A technique was developed for obtaining tone separations from black and white photographic materials. Agfacontour film and photographic derivatives are utilized to improve the density discrimination and decrease the density range from 0.45 to 0.08 units. This increase in capability extends the usefulness of tone separations to a wider range of subject matter and problem areas.
Author

N75-15952*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPARATUS DESCRIPTION AND DATA ANALYSIS OF A RADIOMETRIC TECHNIQUE FOR MEASUREMENTS OF SPECTRAL AND TOTAL NORMAL EMITTANCE
S. Franklin Edwards, Andronicos G. Kantsios, John P. Voros, and W. F. Stewart Washington Feb. 1975 31 p refs
(NASA-TN-D-7798; L-9774) Avail: NTIS HC $3.75 CSCL 14B

The development of a radiometric technique for determining the spectral and total normal emittance of materials heated to temperatures of 800, 1100, and 1300 K by direct comparison with National Bureau of Standards (NBS) reference specimens is discussed. Emittances are measured over the spectral range of 1 to 15 microns and are statistically compared with NBS reference specimens. Results are included for NBS reference specimens, Rene 41, alundum, zirconia, AISI type 321 stainless steel, nickel 201, and a space-shuttle reusable surface insulation.
Author

N75-15953# Royal Aircraft Establishment, Farnborough (England).
MEASUREMENT OF SURFACE CONTOURS USING HOLOGRAPHICALLY STORED INTERFERENCE FIELDS
H. Wachutka, W.-M. Ewers, and K. Barwinkle Nov. 1974 16 p refs Transl. into ENGLISH from Optik (Stuttgart), v. 40, no. 1, 1974 p 69-79
(RAE-Lib-Trans-1804; BR44795) Avail: NTIS HC $3.25

A holographic technique which does not require the stable and vibration free experimental set-up of normal holographic arrangements is described for generating surface contours. Contour lines are formed on the object to be measured by the intersection of the object's surface with a three-dimensional interference field, produced by reconstruction of a suitable hologram. The optical arrangement is calculated from optical image of a reference plane with the interference fringes superimposed on it. These data serve to compute the object's contour. As another application of this technique, the comparison of similar objects to detect small differences in their contours is given.
Author

N75-15954*# Honeywell, Inc., Lexington, Mass. Radiation Center.
LK21T1 S/N V-3 INFRARED DETECTOR
[1974] 34 p
(Contract NAS5-21961)
(NASA-CR-143638; HONEYWELL-24121-2) Avail: NTIS HC $3.75 CSCL 14B

An infrared detector was fabricated to determine the feasibility of atmospheric sounding from synchronous orbit for water vapor and carbon dioxide. The device was extensively tested both before and after a 24-hour soak at 50 C and relative humidity of 95 percent. No degradation in performance as a result of the soak was observed. The device contains a single photoconductive HgCdTe element designed to operate in the six to fifteen micron region.
Author

N75-15955# Los Alamos Scientific Lab., N.Mex.
DELAY LINE READOUT OF ANODE PLANES IN PROPORTIONAL CHAMBERS
D. M. Lee, S. E. Sobottka, and H. A. Thiessen Apr. 1974 6 p refs
(Contract W-7405-eng-36)
(LA-5617-MS) Avail: NTIS HC $3.25

Simple delay lines have been developed for reading out active anode wire locations in multiwire proportional chambers. Anode wire positions are readout using commercial fast logic and time digitization apparatus with no special electronics required.
Author (NSA)

N75-15956# Bendix Corp., Kansas City, Mo.
DEVELOPMENT OF A LIGHT LOAD FRICTION TESTER
D. P. Pope and G. W. Forman 1974 15 p Presented at the Lubrication Conf., Montreal, 8 Oct. 1974
(Contract AT(29-1)-613)
(BDX-613-1104; Conf-741012-1) Avail: NTIS HC $3.25

A new tribometer is described that measures friction characteristics of bonded dry film lubricants under light to moderate loads. Although this tester was designed specifically for loads of approximately 5 grams to several 100 grams, it operates satisfactorily at loads approaching 5 pounds. This apparatus, used as a friction coefficient measuring device, will yield performance data useful in comparing bonded lubricant formulas. As a research tool, it evaluates variation of friction with change in contact stress, contact load, and contact geometry. Controlled experiments using this apparatus might reveal information needed to understand the true nature of bonded film lubrication.
Author (NSA)

N75-15957# Los Alamos Scientific Lab., N.Mex.
OPTICAL DATA PROCESSING OF A HOLOGRAM OBTAINED WITH CODED APERTURE IMAGING
K. S. Han and G. J. Berzins 1974 6 p refs Presented at 18th Ann. Meeting of the Soc. of Photo-Opt. Instrumentation Engr., San Diego, Calif., 19 Aug. 1974 Sponsored by AEC
(LA-UR-74-1110; Conf-740823-1) Avail: NTIS HC $3.25

Spatial filtering techniques are used to enhance images reconstructed from coded aperture holograms. Emphasis is placed

on removing background due to defocussed components (i.e., those corresponding to longitudinally displaced object planes) in the image. Preliminary experimental results are presented. Criteria for using an image reconstruction system as an optical data processing system are discussed. Author (NSA)

N75-15958# California Univ., Livermore. Lawrence Livermore Lab.
ELECTROOPTICAL SCANNER FOR MONITORING ELECTRON BEAM WELDS
Calvin H. Gillespie 11 Jul. 1974 8 p Presented at the ISA Conf., New York, 28 Oct. 1974 Sponsored by AEC
(UCRL-75706; Conf-741014-1) Avail: NTIS HC $3.25

An electrooptical scanner was developed to monitor the quality of an electron beam weld while the weld is being made. The scanning monitor indicates how closely the beam is centered on the joint throughout the length of the weld and provides an indication of the uniformity of the weld by monitoring the light intensity across the weld puddle. The scanning monitor can be used in setting up and aligning the welder, and the oscilloscope display can be photographed to provide a permanent record of the weld. The parameters measured could also serve as input signals to an automatic control system in controlling the welder. Author (NSA)

N75-15959# Kozponti Fizikai Kutato Intezet, Budapest (Hungary).
ENHANCEMENT OF REDUNDANCY IN HOLOGRAMS OF BINARY CODED DATA BY WIDENING OF THE FOURIER SPECTRUM
G. Bencze and P. Varga 1974 12 p refs
(KFKI-74-26) Avail: AEC Depository Libraries HC $4.00

The storage redundancy in Fourier holograms of a binary mask was investigated in the case of each bit of the mask being illuminated separately by an identical form beam. The divergent beam illumination was found to be satisfactory for reaching the required storage redundancy. Author (NSA)

N75-15960# Los Alamos Scientific Lab., N.Mex.
ASSAY OF THE URANIUM CONTENT OF ROVER SCRAP WITH THE RANDOM SOURCE INTERROGATION SYSTEM Informal Report
J. E. Foley and L. R. Cowder Jul. 1974 10 p refs
(Contract W-7405-eng-36)
(LA-5692-MS) Avail: NTIS HC $3.25

A neutron interrogation instrument has been built that determines the uranium content of 10-liter containers of scrap material from the Rover nuclear rocket program. The instrument determines uranium conzent by producing fissions in the sample, and then detecting these fissions by coincidence counting the prompt-fission neutrons and gamma rays. A measurement procedure has been developed that gives assays that are relatively independent of the matrix material in the sample. A normalization procedure has also been developed that eliminates the effects of instrumentation drifts. Author (NSA)

N75-15961# Visidyne, Inc., Burlington, Mass.
DESIGN AND CONSTRUCTION OF A SMALL 5X STEREOSCOPIC REAR PROJECTION VIEWER Final Report, Mar. 1972 - Mar. 1973
T. F. Zehnpfennig, J. M. Berrigan, and W. P. Reidy May 1974 64 p
(Contract F30602-72-C-0298)
(AD-787670; VI-227; RADC-TR-74-128) Avail: NTIS CSCL 09/5

This prototype rear projection viewer allows screening of stereoscopic reconnaissance imagery from the same light table used for detailed analysis functions. It incorporates a unique multiple reflection optical design using front surface mirrors and a beamsplitter to fold the optical path into an unusually compact overall package. Author (GRA)

N75-15962# Honeywell, Inc., Lexington, Mass.
PRELIMINARY DESIGN OF ROCKET-BORNE CRYOGENIC DEWAR AND SIGNAL ELECTRONICS Final Report, Apr. 1972 - Nov. 1973
Carl R. Bohne, William R. Corker, Elton E. Dunbar, Lloyd B. Harkless, and Harold W. Robinson, Jr. Nov. 1973 153 p refs
(Contract F19628-72-C-0325; ARPA Order 1366; AF Proj. 8692)
(AD-787851; AFCRL-TR-73-0746) Avail: NTIS CSCL 04/1

The preliminary design of a cryogenic, rocket-borne dewar and associated signal electronics are described. The design and testing of two cryogenically cooled test dewars are also described. This instrumentation is to be used in connection with rocket probe measurements of the infrared emissions of the airglow and aurorae. (Modified author abstract) GRA

N75-15963*# Stanford Univ., Calif. Microwave Lab.
VACUUM ULTRAVIOLET HOLOGRAPHY
G. C. Bjorklund, S. E. Harris, and J. F. Young Jun. 1974 11 p refs
(Grant NGL-05-020-103; Contracts N00014-67-A-0112-0044; DAHC15-73-G-15)
(NASA-CR-142003; SU-ML-2317; AD-787615) Avail: NTIS HC $3.25 CSCL 14/5

The authors report the first demonstration of holographic techniques in the vacuum ultraviolet spectral region. Holograms were produced with coherent 1182 A radiation. The holograms were recorded in polymethyl methacrylate and read out with an electron microscope. A holographic grating with a fringe spacing of 836 A was produced and far-field Fraunhofer holograms of sub-micron particles were recorded. Author (GRA)

N75-15964# Panametrics, Inc., Waltham, Mass.
NONINTRUSIVE (NONINTERFERING) ULTRASONIC TECHNIQUES TO MEASURE GAS MASS FLOW RATES Final Report, Jul. - Dec. 1973
Lawrence C. Lynnworth, Charles A. Carey, and Norman E. Pedersen Oct. 1974 129 p refs
(Contract F40600-73-C-0011)
(AD-787675; AEDC-TR-74-77) Avail: NTIS CSCL 14/2

An analytic and experimental effort was conducted to determine the range of applicability of ultrasonic flowmeters for gases, and in particular, to determine the optimum nonintrusive ultrasonic flowmeter design for the wind tunnel. This effort included evaluations of six types of ultrasonic flowmeter approaches: transmission, reflection Doppler scatter, beam drift, correlation, noise, and vortex shedding. For a class of duct applications represented by the tested facilities, it was concluded that a transmission measurement would be optimum. A discussion is presented of this system. GRA

N75-15965# Naval Postgraduate School, Monterey, Calif.
ANALYSIS OF A MULTIPURPOSE ELECZRO-OPTICAL SIGNAL PROCESSOR Final Report, 1 May 1973 - 1 Jul. 1974
John P. Powers 20 Jun. 1974 32 p refs
(AD-787475; NPS-52PO7411) Avail: NTIS CSCL 09/5

The report contains an analysis of the technology required for the operation of an electrooptical signal processor. The individual elements consisting of light emitting diodes, photographic transparencies and charge-coupled device (CCD) imaging devices were considered for feasibility of use and potential limitations to system response or applications. Primarily, the system frequency response and dynamic range is restricted by the CCD imaging device. Other trade-offs in the design and application of the system are also indicated. Author (GRA)

N75-15966# Cornell Univ., Ithaca, N.Y. Materials Science Center.
LOW NOISE, PERMANENTLY ADJUSTED UHF SQUID MAGNETOMETER
T. D. Clark and L. D. Jackel 1 Oct. 1974 5 p refs Presented at the Applied Superconductivity Conf., Oakbrook, Ill., Oct. 1974 Sponsored in part by NSF
(Contract N00014-67-A-0077-0016; NR Proj. 319-032)
(AD-787109; MSC-2315; TR-21) Avail: NTIS CSCL 14/2

The report concerns the development of a simple 450MHz SQUID magnetometer, using a symmetric two-hole permanently adjusted point contact SQUID ring. One hole of the SQUID ring is coupled to the center conductor of a resonant superconducting coaxial cavity. A superconducting coil, inserted into the other hole, allows the coupling of an external flux into the SQUID system. The sensitivity is an order of magnitude better than that attained with identical SQUID rings biased at approximately 10MHz. It is shown that this improvement can be achieved

simply and relatively inexpensively, and without sacrificing the excellent flux coupling attainable with such SQUID rings. (Modified author abstract) GRA

N75-15967# Texas Instruments, Inc., Dallas. Central Research Labs.
LIQUID CRYSTAL DISPLAY PANEL Final Report, 1 Apr. 1972 - 28 Feb. 1974
A. R. Kmetz, J. R. Pies, and J. A. Lipman Sep. 1974 56 p
(Contract DAAB07-72-C-0158)
(AD-787328; TI-08-74-37; ECOM-72-0158-F) Avail: NTIS CSCL 09/5

The program objective was to determine the feasibility of a reflective liquid crystal display built directly on a silicon substrate containing an MOS memory and ac drivers. To eliminate chip-to-chip interconnections, the substrate was a mosaic of four 1.7-inch IC chips with low circuit density. Extensive packaging development has culminated in techniques for mosaic fabrication and assembly of a complete display panel. These results are applicable to future designs with simpler integrated circuitry for acceptable yield and lower power. They are also useful for field effect liquid crystal displays and for other display technologies. Design and construction of general interface circuitry and of a specific keyboard adaptor were completed. (Modified author abstract) GRA

N75-15968# Bendix Corp., Sturbridge, Mass. Electro-Optics Div.
POWER SUPPLY FOR 25mm HYBRID IMAGE INTENSIFIER TUBE Final Report
James L. Knak 21 Jan. 1974 25 p
(Contract DAAK02-72-C-0649)
(AD-787460) Avail: NTIS CSCL 09/1

The hybrid image intensifier can be a viable second source for Starlite scope and Crew Served weapon sights. The report covers a power supply design which enables the hybrid tube to perform when used with a 50 caliber machine gun or the 106 recoilless rifle. In addition to provuding proper response, stability and regulation, the design incorporates these special design features. (1) An internal MCP voltage adjustment which allows depot maintenanke to increase tube gain with resulting increased field life for the system. (2) Automatic Brightness Control adjustment which accommodates variations in tube screen efficiencies and thereby improves system yield as well as optimizes performance. (3) An external gain control is provided. Items 1 and 2 can be performed without depotting tube and power supply. Author (GRA)

N75-15969# Colorado State Univ., Fort Collins.
OPTICAL MEASUREMENTS OF SMOKE PARTICLE SIZE GENERATED BY ELECTRIC ARCS Final Report
P. W. Chan Jun. 1974 50 p refs
(Grant EPA-R-800150)
(PB-236580/7; EPA-650/2-74-034) Avail: NTIS HC $3.75 CSCL 14B

The use of light transmission and photometric scattering measurements were studied using lasers for sizing polydispersed metallic particulate systems (often with unknown index of refraction) produced by a dc electric arc smoke generator. The two-angle forward scattering intensity ratio method gives the most accurate results: most important, it does not depend on a knowledge of the refractive index. Average size measurements have been obtained with this technique on several metallic and non-metallic particulate systems; the size distribution can also be obtained by computer calculation. The polarization ratio method gives better sensitivity for smaller sub-micron particles (though dependent on refractive index unless forward scattering is used) and has been used successfully to measure size distribution of sub-micron latex spheres. Also discussed is combining the intensity ratio method (at two forward scattering angles) and the polarization ratio method (at one forward angle) for sizing polydispered particulate systems, and developing it into real-time devices for air pollution control. GRA

N75-15970# TRW Systems Group, Redondo Beach, Calif.
DEVELOPMENT OF AN IMPROVED PRESSURE TRANSDUCER FOR TEST CHAMBER MEASUREMENT Final Report 18 Jun. 1973 - 1 Apr. 1974
R. J. Kurz Oct. 1974 51 p refs
(Contract F40600-73-C-0010)
(AD-787676; AEDC-TR-74-93) Avail: NTIS CSCL 14/2

The present work covers development and evaluation of a revised design of a pressure transducer which is a continuation of an effort to develop an improved ultra-sensitive pressure meter for test chamber measurements. Description of the revised design and performance achieved are presented along with recommendations on further design improvement. Author (GRA)

N75-16477* Kanner (Leo) Associates, Redwood City, Calif.
LARGE NEUTRON COUNTERS FOR SUPERMONITORS
Ya. L. Blokh, L. I. Dorman, V. K. Koiyava, V. Kh. Leonov, Kh. Narziev, and V. G. Chaykovskiy *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 279-281 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 181-182 (For availability see N75-16452 07-93)
CSCL 14B

N75-16479* Kanner (Leo) Associates, Redwood City, Calif.
DESCRIPTION OF AN IONIZATION CALORIMETER COMPLEMENTED WITH PROPORTIONAL COUNTERS
Kh. P. Babayan, N. G. Boyadzhyan, V. V. Vasiltsov, N. L. Grigorov, V. A. Sobinyakov, and V. Ya. Shestoperov *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 287-289 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 186 (For availability see N75-16452 07-93)
CSCL 14B

N75-16481* Kanner (Leo) Associates, Redwood City, Calif.
A SYSTEM FOR MULTICHANNEL RECORDING AND AUTOMATIC READING OF INFORMATION
E. A. Bogomolov, Ye. Ya. Yevstafev, V. K. Karakadko, N. D. Lubyanaya, V. A. Romanov, M. G. Totubalina, and M. A. Yamshchikov *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 293-297 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 190-192 (For availability see N75-16452 07-93)
CSCL 14B

N75-16483* Kanner (Leo) Associates, Redwood City, Calif.
CERTAIN PROBLEMS IN THE DEVELOPMENT AND DESIGN OF SCINTILLATION AND CERENKOV COUNTERS
V. S. Chukin *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 302-307 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 195-198 (For availability see N75-16452 07-93)
CSCL 14B

N75-16487* Kanner (Leo) Associates, Redwood City, Calif.
GAS THRESHOLD CERENKOV COUNTERS
V. I. Logachev, V. G. Sinitsyna, and V. S. Chukin *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 327-332 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 208-211 (For availability see N75-16452 07-93)
CSCL 14B

N75-16490* Kanner (Leo) Associates, Redwood City, Calif.
AN INSTRUMENT FOR THE STUDY OF THE COMPOSITION OF THE ELECTRON COMPONENT OF COSMIC RAYS
E. A. Bogomolov, V. K. Karakadko, N. D. Lubyanaya, V. A. Romanov, M. G. Totuvalina, and M. A. Yamshchikov *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 341-348 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 216-220 (For availability see N75-16452 07-93)
CSCL 14B

N75-16491* Kanner (Leo) Associates, Redwood City, Calif.
SPARK CALORIMETER: AN INSTRUMENT FOR DETERMINING PARTICLE ENERGY OF COSMIC RADIATION
A. A. Alakoz, V. N. Bolotov, M. I. Devishev, L. P. Klimanova, and A. P. Shmeleva *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 349-354 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow,

Nauka Press, 1972 p 221-223 (For availability see N75-16452 07-93)
CSCL 14B

N75-16492* Kanner (Leo) Associates, Redwood City, Calif.
GENERALIZATION OF FORMULAS FOR IONIZATION ENERGY LOSSES AND COLLISION CROSS SECTION IN THRESHOLD DETECTORS
V. K. Yermilova, L. P. Kotenko, G. I. Merzon, and V. A. Chekin *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 355-360 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 224-226 (For availability see N75-16452 07-93)
CSCL 14B

N75-16498* Kanner (Leo) Associates, Redwood City, Calif.
PLASTIC SCINTILLATION COUNTERS WITH AN AREA OF 2 sq m
T. A. Yegorov, N. N. Yefimov, D. D. Krasilnikov, and I. Ye. Sleptsov *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 389-393 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 241-243 (For availability see N75-16452 07-93)
CSCL 14B

36 LASERS AND MASERS

Includes parametric amplifiers.

N75-15971*# Stanford Univ., Calif. Microwave Lab.
INVESTIGATION OF LASER DYNAMICS, MODULATION AND CONTROL BY MEANS OF INTRA-CAVITY TIME VARYING PERTURBATION Semiannual Status Report, 1 Aug. 1974 - 31 Jan. 1975
S. E. Harris, A. E. Siegman, D. J. Kuizenga, A. H. Kung, J. F. Young, G. W. Bekkers, D. M. Bloom, J. H. Newton, and D. W. Phillion Feb. 1975 77 p refs
(Grant NGL-05-020-103)
(NASA-CR-142018; ML-2404; Rept-22) Avail: NTIS HC $4.25 CSCL 20E

The generation of tunable visible, infrared, and ultraviolet light is examined, along with the control of this light by means of novel mode-locking and modulation techniques. Transient mode-locking of the Nd:YAG laser and generation of short tunable pulses in the visible and the alkali metal inert gas excimer laser systems were investigated. Techniques for frequency conversion of high power and high energy laser radiation are discussed, along with high average power blue and UV laser light sources. Author

N75-15972*# Florida Univ., Gainesville.
RESEARCH ON FISSION FRAGMENT EXCITATION OF GASES AND NUCLEAR PUMPING OF LASERS Interim Report
R. T. Schneider, R. N. Davie, J. F. Davis, J. L. Fuller, R. R. Paternoster, G. R. Shipman, D. E. Sterritt, and H. H. Helmick (Los Alamos Scientific Lab.) Dec. 1974 181 p refs
(Grant NGL-10-005-089)
(NASA-CR-142019) Avail: NTIS HC $7.00 CSCL 20E

Experimental investigations of fission fragment excited gases are reported along with a theoretical analysis of population inversions in fission fragment excited helium. Other studies reported include: nuclear augmentation of gas lasers, direct nuclear pumping of a helium-xenon laser, measurements of a repetitively pulsed high-power CO2 laser, thermodynamic properties of UF6 and UF6/He mixtures, and nuclear waste disposal utilizing a gaseous core reactor. F.O.S.

N75-15973*# National Aeronautics and Space Administration. Pasadena Office, Calif.
SOFT X-RAY LASER USING CRYSTAL CHANNELS AS DISTRIBUTED FEEDBACK CAVITIES Patent Application
Frank J. Grunthaner, inventor (to NASA) (JPL) Filed 30 Dec. 1974 17 p
(Contract NAS7-100)
(NASA-Case-NPO-13532-1; US-Patent-Appl-SN-537473) Avail: NTIS HC $3.25 CSCL 20E

A soft X-ray laser is described using channels in a zeolite crystal as distributed feedback (DFB) cavities to produce a laser beam in the X-ray region of the spectrum. The channels have periodic changes in their cross sections such that Bragg-type reflections are generated, leading to DFB of a wave of X-ray photons of lambda = 14.61A, emitted form neon undergoing the characteristic excitation K alpha sub 1,2. Cold neon is forced by a pressure differential through the crystal's channels in one direction, while a beam of electrons sufficient kinetic energy is directed into the channels opposite the neon flow, to excite the neon to emit the X-ray photons at lambda = 14.61A. Using an electron beam with a cross section on the order of 1 micron, an X-ray beam of comparable cross section is emitted from channels of the zeolite crystal in which the excitation of neon takes place. NASA

N75-15974*# National Aeronautics and Space Administration. Pasadena Office, Calif.
DIFFUSED WAVEGUIDING CAPILLARY TUBE WITH DISTRIBUTED FEEDBACK FOR A GAS LASER Patent Application
Charles Elachi, inventor (to NASA) (JPL) Filed 17 Dec. 1974 17 p
(Contract NAS7-100)
(NASA-Case-NPO-13544-1; US-Patent-Appl-SN-533555) Avail: NTIS HC $3.25 CSCL 20E

A description is given of an improved capillary tube in a waveguide gas laser, in which at least a portion of the tube's opening, defined by its inner surface, is corrugated to provide distributed feedback. The tube also has a diffused region which acts as a waveguide for the waves. The evanescent component of the waves travelling in the diffused region interact with laser gas in the opening causing an energy increase which in turn amplify waves travelling in the region. NASA

N75-15975*# Smithsonian Astrophysical Observatory, Cambridge, Mass. Center for Astrophysics.
PHOTORECEIVER EFFICIENCY MEASUREMENTS
C. G. Lehr Jan. 1975 41 p refs Prepared in cooperation with Harvard Coll. Observatory, Cambridge, Mass.
(Grant NGR-09-015-002)
(NASA-CR-142070; SAO-Laser-Rept-6) Avail: NTIS HC $3.75 CSCL 20E

The efficiency and other related parameters of Smithsonian Astrophysical Observatory's four laser receivers were measured at the observing stations by oscilloscope photography. If the efficiency is defined as the number of photoelectrons generated by the photomultiplier tube divided by the number of photons entering the aperture of the receiver, its measured value is about 1% for the laser wavelength of 694 nm. This value is consistent with the efficiency computed from the specified characteristics of the photoreceiver's optical components. Author

N75-15976# Defence Research Establishment Valcartier (Quebec).
EXPERIMENTS ON SIMULATED SELF-INDUCED THERMAL DISTORTION OF LASER BEAMS
L. R. Bissonnette and M.-A. Rioux Oct. 1974 25 p refs
(DREV-R-2125/74) Avail: NTIS HC $3.25

Laboratory simulation of absorption-induced phenomena distorting long duration > 0.1 s), intense, 10.6 micrometers laser pulses propagating horizontally is described. The experimental approach, the measurement techniques, the data acquisition and recording, and the basic method of data analysis are discussed at length. Preliminary results are reported and confirm a number of theoretical predictions concerning the scales and the configuration of the distorted irradiance patterns. Experimental evidence of a particular form of focusing produced by the absorption-induced free convection currents is shown. Author

N75-15977# California Univ., Livermore. Lawrence Livermore Lab.
USE OF RELATIVISTIC ELECTRON BEAMS FOR THE STUDY OF CHEMICAL AND RARE GAS LASER SYSTEMS Ph.D. Thesis
B. Krawetz 12 Mar. 1974 77 p refs
(Contract W-7405-eng-48)

(UCRL-51402) Avail: NTIS HC $4.75

Chemical (NF3 + H2) and rare gas molecular (Xe2, Kr2, Ar2) laser systems are examined. Intense relativistic electron beams are used as a source of initiation and stimulation respectively. For the high gain chemical system, nonlinear amplification and pulse propagation are examined. The experimental result shows all the qualitative features of the theoretical prediction. In addition certain kinetic excitation and deactivation mechanisms are studied through the short stimulation time available with the electron beam. Results obtained from the examination of laser action of the test system compare well with more conventional schemes for kinetic rate data extraction. For rare gas molecular systems, the electron beam provided an excellent tool for studying the energy flow beginning with formation of the diatomic eximer to final decay by spontaneous radiative decay. Laser action in Krypton (Kr2) is predicted. Symmetry in excitation mechanisms is demonstrated for the rare gases as a class. Author (NSA)

N75-15978# University of Southern Calif., Los Angeles. Electronic Sciences Lab.

IR WINDOW STUDIES

Ferdinand A. Kroger and John H. Marburger 15 Mar. 1974 67 p refs

(Contract F19628-72-C-0275; ARPA Order 2055)

(AD-787852; USCEE-472; AFCRL-TR-74-0268; QTR-7) Avail: NTIS CSCL 20/5

Contents: Use of zirconia as gages and pumps for GaAs epitaxial growth; Optimization of alkali halide window materials; Fabrication of polycrystalline IR window material; Mechanical behavior of II-VI and III-V compounds; Dielectric constant measurements; Study of defects in II-VI compounds; Theoretical studies of absorption mechanisms in IR window materials; Wavelength and temperature dependent calorimetry measurements on GaAs; Acoustic probe studies of surface properties; Absorption studies of CdTe and ZnSe; Characterization of optical performance of IR window systems; Initial investigation of the role of inclusion damage in the failure of 10.6 micrometer optics. GRA

N75-15979# Hughes Research Labs., Malibu, Calif.

EXPERIMENTAL CHEMICAL LASER MODE CONTROL Final Report, 16 Mar. - 15 Aug. 1974

D. B. Rensch Oct. 1974 75 p refs

(Contract DAAH01-74-C-0596)

(AD-787143) Avail: NTIS CSCL 20/5

An experimental study was performed on integer and integer plus one-half valued equivalent Fresnel number positive branch confocal unstable resonators in a DF-CO2 flash-photolysis chemical laser. Near diffraction limited beam quality was obtained for a range of geometric output couplings from 30% to 77%. No dependence of beam quality on the resonator Fresnel number was found. This was true for uniform medium conditions as well as perturbed conditions where significant phase perturbation were introduced into the optical resonator. Extensive medium diagnostics were performed on the DF-CO2 laser and the results presented. Author (GRA)

N75-15980# Naval Postgraduate School, Monterey, Calif.

AN EXPERIMENTAL INVESTIGATION OF SHORT DIFFUSERS FOR GAS DYNAMIC LASERS M.S. Thesis

John Joseph Zerr Jun. 1974 52 p refs

(AD-787436) Avail: NTIS CSCL 20/5

One of the largest components of a gas dynamic laser is the diffuser. A significant reduction in the size of this component could represent a significant savings in the size and weight of the entire system. The purpose of this investigation was to examine several short supersonic diffuser designs with fixed walls and no boundary layer control. Thick diffusers with shallow ramp angles are supposed to provide optimum pressure recovery for fixed diffusers. It was found in this investigation, however, that no loss of pressure recovery is suffered when steep ramp angles and thin diffusers are used. Steep ramps and thin diffuser sections would serve to minimize both the length and weight of supersonic diffusers. Start-up times were also investigated. (Modified author abstract) GRA

N75-15981# Aerospace Corp., El Segundo, Calif. Lab. Operations.

INTERACTION BETWEEN UNSTABLE OPTICAL RESONATOR AND CW CHEMICAL LASER Interim Report

Harold Mirels 15 Sep. 1974 40 p refs

(Contract F04701-74-C-0075)

(AD-787716; TR-0075(5240-50)-1; SAMSO-TR-74-209) Avail: NTIS CSCL 20/5

The interaction between an unstable resonator and a CW diffusion-type chemical laser with turbulent or laminar mixing is analyzed by means of geometric optics and a simplified chemical model. Both cylindrical and spherical optics are considered. The radiation is assumed to be diverging, i.e., converging radiation is neglected, and the gain region is assumed adjacent to one of the resonator mirrors. Laser performance is found to depend on the magnification, the ratio of pumping to collisional deactivation rate, the normalized diffusion distance, the normalized axial location of resonator axis, the normalized axial length of resonator, the mirror absorptivity, and the net zero power gain. Analytic solutions are obtained for the limiting cases (M - 1) mach - and 1/M mach -. In the former case, the laser medium is almost completely saturated, and resonator efficiency is high. In the latter case, the radiation incident on the gain region originates near the optical axis and is uniform. GRA

N75-15982# Naval Research Lab., Washington, D.C.

ARPA/NRL X-RAY LASER PROGRAM Semiannual Technical Report, 1 Jan. - 30 Jun. 1974

R. A. Andrews, R. C. Elton, J. Reintjes, R. C. Eckardt, and R. H. Lehmberg Oct. 1974 141 p refs

(DARPA Order 2694)

(AD-787626; NRL-MR-2910) Avail: NTIS CSCL 20/5

The ARPA/NRL X-ray laser program is concerned with demonstrating gain in the soft X-ray region. The program is jointly supported by ARPA and NRL. The approaches include electron-collisional pumping in picosecond laser pumped plasma, resonant charge transfer pumping, optical parametric mixing to short wavelengths, traveling wave e-beam pumping, and analysis and numerical modeling. This report covers the progress made during the second half of FY-74. Author (GRA)

N75-15983# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

INTENSITY, COHERENCE, AND FREQUENCY SPECTRUM OF A FOCUSSED BEAM IN A RANDOM MEDIUM Physical Sciences Research Papers

Donald L. Fante 26 Jul. 1974 22 p refs

(AF Proj. 2153)

(AD-787651; AFCRL-PSRP-598; AFCRL-TR-74-0335) Avail: NTIS CSCL 20/5

Numerical results have been obtained for the effect of the strength of turbulence on the intensity, mutual coherence function, and frequency spectrum of a focussed beam propagating in a random medium having a von Karman spectrum for the index of refraction fluctuations. The author has presented conditions for when the turbulence affects the nature of the beam and has demonstrated the validity of these conditions by comparison with the numerical results. Author (GRA)

N75-15984# Naval Research Lab., Washington, D.C.

TOWARDS SHORTER WAVELENGTH LASERS AND BREAKING THE 1000 ANGSTROM BARRIER. 2: BOUND CONTINUUM EMISSION Interim Report

A. W. Ali Aug. 1974 26 p refs

(NRL-Proj. N01-33)

(AD-787625; NRL-MR-2863) Avail: NTIS CSCL 20/5

Bound-continuum lasers in the vacuum ultraviolet are discussed, and criteria are developed for their realization. Furthermore, the possibility of a new CW laser in the vacuum ultraviolet (1550A) from H2, HD and D2 is investigated. It is pointed out that in a two temperature, continuously operating discharge, this laser is highly feasible. GRA

N75-15985# Raytheon Co., Waltham, Mass. Research Div.

ADVANCED TECHNIQUES FOR IMPROVING LASER OPTICAL SURFACES Semiannual Technical Report, 1 Jan. - 30 Jun. 1974

Charles B. Willingham Sep. 1974 73 p refs

(Contract F19628-73-C-0280; AF Proj. 2415)

(AD-787780; S-1721; AFCRL-TR-74-0384; SATR-2) Avail: NTIS CSCL 20/5

This program is a study of surface-finishing techniques considered to be capable of improving the surface quality of laser optical materials. A variety of conventional and superpolishing techniques will be developed for single-crystal and polycrystalline potassium chloride and calcium fluoride, and crystalline zinc selenide. Acceptable conventional polishing techniques for polycrystalline calcium fluoride and zinc selenide were developed, and preliminary grinding steps of the process were identified as requiring further study. Bowl-feed superpolishing was shown to improve the surface quality of conventionally polished zinc selenide and calcium fluoride substantially. Zinc sulfide powders were evaluated as infrared-transparent abrasives for potassium chloride and found to be inferior to alumina. Light scattering measurements demonstrated that ion milling could be used to clean surfaces prior to deposition of optical coatings without seriously degrading them, but that more extensive material removal sharply increased scattering at angles close to the specular direction. (Modified author abstract) GRA

N75-15986# United Aircraft Corp., East Hartford, Conn. Research Labs.
DEVELOPMENT OF A MINIATURIZED DYE LASER Interim Report, 10 Aug. - Oct. 1974
William H. Glenn 7 Oct. 1974 17 p
(Contract N60921-74-C-0339)
(AD-787613; UARL-N921952-2; IR-2) Avail: NTIS CSCL 20E

The objective of this program is to develop a miniaturized dye laser suitable for a variety of applications, particularly in an underwater environment. The following tasks have been performed: Re-evaluate alternative pumps cavity configurations; Perform preliminary tests of promising new coumarin dyes; Investigate the use of increased flashlamp input energy; Evaluate the use of reduced arc length and of arc image defocussing to reduce pulse amplitude fluctuations; Redesign the laser resonator for improved efficiency; Investigate the effects of dye filtering and increased dye flow rates; Demonstrate laser operation with 100 watt usable peak power output, at a pulse repetition rate of at least 200 pps, for a non-stop operating period in excess of 20 seconds. This interim report presents a summary of the results of these investigations, followed by a brief outline of plans for continuing work in the next reporting period. GRA

N75-15987# United Aircraft Corp., East Hartford, Conn. Research Labs.
CHIRP MODULATED CO2 LASER RADAR OSCILLATOR Final Technical Report, 1 Feb. - 31 Aug. 1974
A. Stein Sep. 1974 43 p refs
(Contract N00014-74-C-0218; ARPA Order 1806)
(AD-787606) Avail: NTIS CSCL 20/5

The objective of this program was to investigate intracavity electrooptical phase modulation of a CO2 waveguide laser with the aim of constructing a frequency-chirped master oscillator for application in a 10 micrometer imaging radar. During this six-month program a special phase sampling technique for frequency locking of the modulated master oscillator to an unmodulated reference laser was investigated. An important experimental result was the measurement of the relative phase between the two lasers by this sampling technique. The development of the UARL waveguide lasers was continued resulting in a sealed-off, reliable laboratory device of 0.3 W output power and a lifetime of about 1,000 hrs yielding repetitive linear chirps of 75 MHz width and 2 microsec duration. (Modified author abstract) GRA

N75-15988# GTE Labs., Inc., Waltham, Mass.
HIGH ENERGY PULSED LIQUID LASER Final Technical Report, 1 Jul. 1967 - 31 Mar. 1974
H. Samelson and R. Kocher 30 Aug. 1974 430 p
(Contract N00014-68-C-0110; ARPA Order 1806)
(AD-787895; TR-74-826.1) Avail: NTIS CSCL 20/5

The objectives of the project were to evaluate inorganic liquid laser materials in high average power and high brightness applications. The reported work extends from research on the laser materials to system design and construction. This report is divided into the following technical sections: the chemistry and properties of liquid laser materials; liquid laser systems, including static and circulatory systems and system, sub-system and component design; the hydrodynamic and thermo-optical properties of liquid lasers; and laser and amplifier behavior (static and circulatory), including high average and power performance, self Q-switching, mode locking, and the limitations of inorganic liquid systems in terms of nonlinearities and optical quality. (Modified author abstract) GRA

N75-15989# Stanford Research Inst., Menlo Park, Calif.
STUDIES OF E-BEAM PUMPED MOLECULAR LASERS Technical Report, 1 Jul. 1973 - 30 Jun. 1974
R. M. Hill, R. A. Gutcheck, D. L. Huestis, D. Mukherjee, and D. C. Lorents 31 Jul. 1974 68 p refs
(Contract N00014-72-C-0478; ARPA Order 1807)
(AD-787079; SRI-MP74-39; TR-3) Avail: NTIS CSCL 07/4

The authors describe experimental and theoretical studies which examine the feasibility of attaining laser action in high pressure gas mixtures (in particular Ar - N2 - NO) excited by electron beam pulses. Using photometrical and photographical means, then have measured 14 reaction rate coefficients for this system, and were able to determine that there exists large populations of metastable excited N2 (implying long lived high energy storage capacity). A kinetic model program describing the complex interaction of the gases has been developed which agrees well with experiment. This model can predict potential laser efficiencies of the following N2 transitions: an efficiency of almost 1% for the 2(0-1) band, 1.8% for the 1- (0-0) band, and the possibility of efficient lasing in the V-K system. (Modified author abstract) GRA

N75-15990# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MECHANISM OF DESTRUCTION OF TRANSPARENT DIELECTRICS SUCH AS ORGANIC GLASS BY LASER RADIATION
N. P. Nobikov 4 Oct. 1974 18 p refs Transl. into ENGLISH from Mekhan. Polimerov, Akad. Nauk Latv. SSR (Riga), no. 2, Mar./Apr. 1973 p 232-238
(AD-787340; FTD-HT-23-1344-74) Avail: NTIS CSCL 20/5

A gas formation mechanism is proposed in which the polymer radicals split off and gas molecules are subsequently formed. The authors study the development kinetics of this process, in which the microstructure of the material plays a substantial role. In this case failures which develop in transparent dielectrics such as PMMA (polymethylmethacrylate), PS (polystyrene), PC (polycarbonate) etc., under the influence of laser radiation are determined by two types of processes the development mechanics of the destroying cracks and the physics of interaction between the laser radiation and the solid. GRA

N75-15991# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
INITIAL STUDIES ON A MONOPROPELLANT CHEMICAL LASER SYSTEM UTILIZING NITROSYL CYANIDE M.S. Thesis
Larry D. Buelow Sep. 1974 72 p refs
(AD-787694; GA/CH/74S-1) Avail: NTIS CSCL 07/4

A continuous gas flow method for the production of nitrosyl cyanide has been devised and the potential of using nitrosyl cyanide in a pumping reaction for a monoreagent CO laser is discussed. The infrared, visible, and ultraviolet spectra have been recorded. The infrared analysis located and assigned vibrational fundamentals. The diagonal force constants were determined. Some thermodynamic properties are reported. (Modified author abstract) GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N75-15992* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
BONDING OF SAPPHIRE TO SAPPHIRE BY EUTECTIC MIXTURE OF ALUMINUM OXIDE AND ZIRCONIUM OXIDE Patent

John J. DeLuca, inventor (to NASA) Issued 14 Jan. 1975 4 p Filed 12 Jan. 1973 Supersedes N73-19467 (11 - 10, p 1164)
(NASA-Case-GSC-11577-1; US-Patent-3,859,714; US-Patent-Appl-SN-322997; US-Patent-Class-29-472.7; US-Patent-Class-65-43; US-Patent-Class-156-89; US-Patent-Class-156-99; US-Patent-Class-117-93.3; US-Patent-Class-117-106A; US-Patent-Class-29-473.1) Avail: US Patent Office CSCL 13H

Bonding of an element comprising sapphire, ruby or blue sapphire to another element of such material with a eutectic mixture of aluminum oxide and zirconium oxide is discussed. The bonding mixture may be applied in the form of a distilled water slurry or by electron beam vapor deposition. In one embodiment the eutectic is formed in situ by applying a layer of zirconium oxide and then heating the assembly to a temperature above the eutectic temperature and below the melting point of the material from which the elements are formed. The formation of a sapphire rubidium maser cell utilizing eutectic bonding is shown. Official Gazette of the U.S. Patent Office

N75-15993*# Franklin Inst. Research Labs., Philadelphia, Pa.
STEADY-STATE AND DYNAMIC PERFORMANCE OF A GAS-LUBRICATED SEAL Final Report
R. Colsher and W. Shapiro Nov. 1972 158 p refs
(Contracts NAS3-16863)
(NASA-CR-121093; F-C3452-1) Avail: NTIS HC $6.25 CSCL 13I

Steady-state and dynamic performance of a gas-lubricated, self-acting face seal was determined using numerical methods based on a variable grid, finite-difference, time-transient procedure. Results were obtained for a gas turbine main shaft seal operating at 206.9 newton per square centimeter (300 psi) sealed air pressure and 152.4 meters per second (500 ft/sec) sliding velocity. Analysis of the seal dynamics revealed that the response of the seal nosepiece to runout of the seat face is markedly affected by secondary seal friction and by nosepiece inertia. The nosepiece response was determined for various levels of secondary seal friction and seat face runout magnitudes. Author

N75-15994*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PRELOAD TORQUE LIMITING SHAFT COUPLING Patent Application
Wayne A. Harmening, inventor (to NASA) (RCA) Filed 17 Jan. 1975 8 p
(Contract NAS1-9000)
(NASA-Case-LAR-11398-1; US-Patent-Appl-SN-541822) Avail: NTIS HC $3.25 CSCL 13I

A torque limiting spring for a rotating shaft system which acts bidirectionally and is preloaded is examined. The spring is a split circular ring compressed into cavities on facing surfaces of matching shafts. The spring is preloaded by varying the width of a tang in the shaft cavity relative to the split in the spring. NASA

N75-15995*# Benedict Coll., Columbia, S.C.
STUDY ON THE APPLICABILITY OF A PRECISE, ACCURATE METHOD FOR RAPID EVALUATION OF ENGINE AND LUBRICANT PERFORMANCE Final Technical Report, 21 Jan. 1974 - 21 Jan. 1975
James T. Kinard 21 Jan. 1975 14 p refs
(Grant NsG-8004)
(NASA-CR-142012) Avail: NTIS HC $3.25 CSCL 11H

The development of a procedure for obtaining data related to wear metal determinations in used lubricants is discussed. The procedure makes it possible to obtain rapid, simultaneous determinations of a number of wear metals at levels of parts per thousand to low parts per billion using a small amount of sample. The electrode assembly and instrumentation used in the process are described. Samples of data obtained from tests conducted under controlled conditions are tabulated. Author

N75-15996*# Marquardt Corp., Van Nuys, Calif.
SPACE SHUTTLE OMS HELIUM REGULATOR DESIGN AND DEVELOPMENT Final Report
H. Wichmann, T. L. Kelly, and R. Lynch 31 May 1974 263 p refs
(Contract NAS9-12992)
(NASA-CR-141562; S-1296) Avail: NTIS HC $8.50 CSCL 13G

Analysis, design, fabrication and design verification testing was conducted on the technological feasiblity of the helium pressurization regulator for the space shuttle orbital maneuvering system application. A prototype regulator was fabricated which was a single-stage design featuring the most reliable and lowest cost concept. A tradeoff study on regulator concepts indicated that a single-stage regulator with a lever arm between the valve and the actuator section would offer significant weight savings. Damping concepts were tested to determine the amount of damping required to restrict actuator travel during vibration. Component design parameters such as spring rates, effective area, contamination cutting, and damping were determined by test prior to regulator final assembly. The unit was subjected to performance testing at widely ranging flow rates, temperatures, inlet pressures, and random vibration levels. A test plan for propellant compatibility and extended life tests is included. Author

N75-15997*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN OF AN OIL SQUEEZE FILM DAMPER BEARING FOR A MULTIMASS FLEXIBLE-ROTOR BEARING SYSTEM
Robert E. Cunningham, Edgar J. Gunter, Jr. (Virginia Univ.), and David P. Fleming Washington Feb. 1975 31 p refs
(NASA-TN-D-7892; E-7888) Avail: NTIS HC $3.75 CSCL 13I

A single-mass flexible-rotor analysis was used to optimize the stiffness and damping of a flexible support for a symmetric five-mass rotor. The flexible, damped support attenuates the amplitudes of motions and forces transmitted to the support bearings when the rotor operates through and above its first bending critical speed. An oil squeeze film damper was designed based on short bearing lubrication theory. The damper design was verified by an unbalance response computer program. Rotor amplitudes were reduced by a factor of 16 and loads reduced by a factor of 36 compared with the same rotor with rigid bearing supports. Author

N75-15998# Royal Aircraft Establishment, Farnborough (England).
THE WELDING OF TITANIUM
B. Blanchet Nov. 1974 18 p refs Transl. into ENGLISH from Rev. Met. (Paris), v. 71, no. 1, 1974 p 99-105
(RAE-Lib-Trans-1817; BR44610) Avail: NTIS HC $3.25

Conventional fusion welding processes for titanium alloys are considered, together with electron beam and plasma welding. The corrosion of welded assemblies is discussed. Diffusion bonding and brazing of titanium alloys, and variable clearance experiments with a Ti-Cu-Ni brazing alloy are described. Difficulties encountered with all the joining processes and the methods adopted to overcome them are discussed. It is suggested that the alloys can be considered to have good weldability and it is concluded that provided a number of simple precautions are carried out sound welds can be produced. Author

N75-15999# Royal Aircraft Establishment, Farnborough (England).
THE FEASIBILITY OF EMPLOYING GAS BEARINGS IN GYROS
R. Unterberger 1974 24 p refs Transl. into ENGLISH from the 1974 DGON Symp. on Gyro Technol.
(RAE-Lib-Trans-1796; BR44649) Avail: NTIS HC $3.25

The use of gas bearings in the rotor and gimbal axes of gyroscopes is described. The main discussion is on a spherical aerostatic bearing and covers the driving arrangement and the disturbance moments in the configuration. Author

N75-16000*# Stanford Research Inst., Menlo Park, Calif.
PASSIVATION OF PIGMENT PARTICLES FOR THERMAL CONTROL COATINGS Interim Final Report
K. M. Sancier, S. R. Morrison, and E. P. Farley Apr. 1974 13 p refs
(Contract NAS8-21270; SRI Proj. PYU-7083)
(NASA-CR-120601) Avail: NTIS HC $3.25 CSCL 11C

Various redox couple surface additives are studied which

increase the photostability of coprecipitated zinc orthotitanate pigment. The electron spin resonance technique was used to examine the characteristic photodamage centers. Results indicate that cerium surface redox additive completely passivates the pigment at the surface concentrations studied. Less passivation occurs with the iridium chloride and the iron cyanide redox couples. N.E.R.

N75-16001*# Colspan, Inc., Boulder, Colo.
EXTERNAL INSULATION SYSTEMS FOR CRYOGENIC STORAGE SYSTEMS. VOLUME 1: OPTICAL PROPERTIES OF KAPTON AND REPORT OF PROCESS VARIABLE STUDY Final Report
Alan M. Frank 30 Aug. 1974 55 p refs 2 Vol.
(Contract NAS9-10583)
(NASA-CR-141481) Avail: NTIS HC $4.25 CSCL 13H

Investigations are conducted into the optical properties of the glass and Kapton substrate materials, and three variables were chosen: deposition rate, sputter gas pressure, and film contamination time. Substrate tests have shown that fabrication of an dielectric broadband reflector would require an extremely complex and expensive filter design. M.C.F.

N75-16002# Commissariat a l'Energie Atomique, Saclay (France). Dept. de Technologie.
PROGRESS REALIZED IN THE AUTOMATIC CONTROL BY ULTRASONICS OF WELDS OF AUSTENITIC STAINLESS STEEL USING FOCALIZED TRANSDUCER
R. Saglio and M. Roule Feb. 1973 4 p In FRENCH Presented at the Intern. Colloq. on the Welding of Austenitic Steel Meeting, Brussels, 8-9 Oct. 1973
(CEA-Conf-2609; Conf-731084-1) Avail: AEC Depository Libraries HC $4.00

The use of focalized tranducers to weld austenitic stainless steel joints is discussed. Special attention is given to weld quality, weld angle, and defect dimension. Several examples are given of industrial welds produced by the transducers.
Transl. by E.H.W.

N75-16003# Bendix Corp., Kansas City, Mo.
CHARACTERIZATION OF THERMOCOMPRESSION BONDING PARAMETERS FOR BEAM-LEAD BONDING
D. A. Youngberg and B. W. Lenhardt 1974 24 p refs Presented at the Intern. Soc. of Hybrid Microelectronic Symp., Boston, 21 Oct. 1974
(Contract AT(29-1)-613)
(BDX-613-1175; Conf-741004-3) Avail: NTIS HC $3.25

Thermocompression (TC) bonding is a technique used to weld two similar materials by application of heat and pressure for a specific time. To obtain reliable, consistent beam-lead attachment by TC bonding, each bonding parameter value must be known and controlled. The TC bonding schedules are developed to determine parameter boundary values that depend on the fundamental physics of the bonding process. This necessitates thorough TC bonder characterization (definitions of limits). Practical considerations of beam-lead wobble-tool bonding and techniques used to characterize bonding tool temperature, work-stage temperature, bond time or wobble speed, and bond force are discussed. Author (NSA)

N75-16004# Ames Lab., Iowa.
USE OF INERT ATMOSPHERES IN THE PREPARATION AND HANDLING OF HIGH PURITY RARE EARTH METALS
B. J. Beaudry and P. E. Palmer 1974 9 p refs Presented at 11th Rare Earth Res. Conf., Traverse City, Michigan, 7 Oct. 1974 Sponsored by AEC
(IS-M-23) Avail: NTIS HC $3.25

The results of studies on the preparation of the rare earth metals by the calcium reduction of the rare earth fluorides under various conditions were presented. It was shown that the major role of an inert atmosphere during the room temperature handling operations is to keep the calcium from oxidizing and to protect the as-reduced metal from the air. The effect of the reactants purity on the purity of the final product is also discussed. Data on the contamination of rare earth metals during cold-working and heat-treating procedures are presented. Methods to minimize contamination from the various mechanical operations and heat treating are described. Author (NSA)

N75-16005# Oak Ridge National Lab., Tenn.
HEAVY SECTION STEEL TECHNOLOGY PROGRAM Semiannual Progress Report, period ending 31 Aug. 1973
Jul. 1974 111 p refs
(Contract W-7405-eng-26)
(ORNL-4971) Avail: NTIS HC $5.25

Research directed to extending and developing the technology for quantitatively assessing margins of safety against fracture of the primary containment systems of reactors is reported. Results are summarized in sections devoted to investigations of unirradiated steels, investigations of irradiated steels, and investigations of pressure vessels and piping. NSA

N75-16006# Sandia Labs., Albuquerque, N.Mex.
PLASMA SPRAYING Nb/Al2O3 CERMETS
Kieth Rowe Aug. 1974 15 p
(Contract AT(29-1)-789)
(SLL-74-0028) Avail: NTIS HC $3.25

A technique is described for plasma spraying strong, dense cermets consisting of niobium and Al2O3. This technique may provide a means for fabricating cermets of components that react at conventional powder metallurgical temperatures.
Author (NSA)

N75-16007# Mechanical Technology, Inc., Latham, N.Y.
DESIGN AND TEST OF A HELIUM GAS SPRING Final Report, Jun. 1973 - 30 Apr. 1974
Peter W. Curwen, Harlan V. White, and Stanley Gray 10 May 1974 117 p refs
(Contract N00014-73-C-0440)
(AD-787142; MTI-74TR28) Avail: NTIS CSCL 13/10

Development of a linear-motor resonant-piston compressor (LMRPC) for helium cryogenic refrigerators is under consideration by the U.S. Navy. A critical component of the LMRPC is the gas spring assembly used to obtain 60 Hz resonance of the reciprocating compressor parts. Because of the size of the compressor, and the high level of compressor efficiency desired by the Navy, design of the gas spring is particularly critical with respect to minimizing gas spring leakage and thermal losses. The primary objective of the reported design and test program was to determine if a satisfactory gas spring can be developed for use in a prototype helium LMRPC. A further objective was to demonstrate that gas-lubricated bearings can be used to provide wear-free, contamination-free support of the reciprocating assembly of the LMRPC. (Modified author abstract) GRA

N75-16008# Midwest Research Inst., Kansas City, Mo.
PERFORMANCE OF LUBRICANT COMPACT MATERIALS IN BALL BEARINGS Technical Report, 2 Jan. - 15 Apr. 1974
Karl R. Mecklenburg Sep. 1974 46 p refs
(Contract F33615-72-C-1374; AF Proj. 7340; AF Proj. 7343)
(AD-787849; AFML-TR-74-181) Avail: NTIS CSCL 11/8

Operational data on six lubricant compact materials, installed in nine ball bearings, are presented. The compact materials are MoS2-Mo-Ta, MoS2-Mo-Nb-Cu, WS2-Co-Ag and MoS2-Ta. The formation process is outlined. A description of the test rigs used in the work is presented. The two basic types of ball bearing test specimens are described, as are the two ball separator designs. The compact inserts were either cylindrical or conical and were installed in either aluminum or titanium separators. The operating life results are presented, with the compact materials classified as either early failure or prolonged operation. Weight loss data are presented, from which wear rate data were calculated. Frictional torque measurements are included, as are the vacuum levels in the test chambers. Operational wear lives were predicted for the five bearings still operating, using a conservative quantity of available compact material and the calculated wear rates. Conclusions relative to the compact materials and bearing performance are included. (Modified author abstract) GRA

N75-16009# Little (Arthur D.), Inc., Cambridge, Mass.
INVESTIGATION OF SCROLL FLUID MACHINERY FOR CRYOGENIC HELIUM REFRIGERATORS Final Report, 1 Jun. - 31 Dec. 1973

Raymond W. Moore, Jr. Mar. 1974 97 p refs
(Contract N00014-73-C-0451; NR Proj. 274-177)
(AD-787056; ADL-C-75976-F) Avail: NTIS CSCL 13/1

The objective of the program was to investigate the applicability of scroll fluid machinery (compressors and expanders) to cryogenic helium refrigerators or liquefiers for superconductive ship propulsion systems. Thermodynamic cycles for appropriate refrigerator/liquefier systems were analyzed; and, based on the results of this analysis, typical performance characteristics for a scroll compressor and a scroll expander suitable for these systems were defined. Design requirements for the scroll compressor, a 90 SCFM unit with a 16 to 1 pressure ratio, are established and a design for an experimental oil-lubricated unit suitable for laboratory testing is evolved. The design is based, in part, on information obtained from tests on the Arthur D. Little, Inc. (ADL) 1 to 3 Hp scroll compressor. The results of these tests are described. (Modified author abstract) GRA

N75-16010# Battelle Columbus Labs., Ohio.
HOT ISOSTATIC PRESSURE HEALING OF NAVY GUN METAL CASTINGS Final Report
D. A. Seifert and H. D. Hanes Sep. 1974 42 p
(Contract N00024-73-C-5375)
(AD-787598) Avail: NTIS CSCL 13/8

The report summarizes the investigation of the use of Hot Isostatic Pressure (HIP) processing to heal defects in Navy Gun Metal castings. The effects of HIP processing temperature at 15,000-psi pressure on the mechanical properties, microstructure, and cast-in porosity in G-metal were investigated. HIP at temperatures between 1250 and 1500 F were found to practically eliminate porosity. Gas permeable porosity was eliminated in every case. Increases in yield strength of 14 percent, ultimate tensile strength of 37 percent, and elongation of 100 percent were obtained compared to as-cast properties. Dendritic segregation was reduced and second phase material redissolved as a result of HIP processing. The HIP conditions developed were applied to the processing of cast 4-in. flex connector bodies with generally similar results. (Modified author abstract) GRA

N75-16011# California Univ., Los Angeles. Dept. of Materials.
ACOUSTIC EMISSION DURING ELECTRO AND ELECTROLESS PLATING
Osamu Takano and Kanji Ono Jul. 1974 23 p refs Presented at the 2nd Acoustic Emission Symp., Tokyo, 2-4 Sep. 1974
(Contract N00014-69-A-0200-4031)
(AD-787087; UCLA-ENG-7473) Avail: NTIS CSCL 11/3

This paper reports acoustic emission characteristics during electro-plating of chromium and copper as well as those during electroless nickel plating. Acoustic emission pulses are produced by the generation of cracks in the deposit layer and can be used in monitoring the plating quality. (Modified author abstract) GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N75-16012# Naval Postgraduate School, Monterey, Calif.
SENSITIVITY ANALYSIS OF A RELIABILITY ESTIMATION PROCEDURE FOR A COMPONENT WHOSE FAILURE DENSITY IS A MIXTURE OF EXPONENTIAL FAILURE DENSITIES M.S. Thesis
Martinus Hartun Sunjata Sep. 1974 88 p refs
(AD-787369) Avail: NTIS CSCL 12/1

The failure rate lambda, of components with exponential failure times, because of the manufacturing process of the components, behaves as a random variable. Assuming lambda is gamma distributed with shape parameter alpha and scale parameter beta, the reliability estimate of the components can be expressed as R prime (t) = 1/(1 + beta prime (t) to the (alpha prime) power where (alpha prime) and (beta prime) are the maximum likelihood estimators of alpha and beta respectively. The accuracy of this estimate is analyzed when the distribution of lambda is discretely distributed rather than gamma distributed. Author (GRA)

N75-16013# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
A SUMMARY AND ANALYSIS OF SELECTED LIFE CYCLE COSTING TECHNIQUES AND MODELS M.S. Thesis
Lawrence E. Dover and Billie E. Oswald, Jr. Aug. 1974 181 p refs
(AD-787183; SLSR-18-74B) Avail: NTIS CSCL 15/3

Operational costs continue to recur throughout the life of a weapon system and normally represents the majority of life cycle costs. Presented are an Annotated Bibliography of Selected Life Cycle Costing Literature and a Taxonomy of Selected Life Cycle Cost Models. The Annotated Bibliography is sectionalized into six areas: Directives and Guides; General Philosophy and Methodology; Reliability and Maintainability; Cost-Effectiveness; Cost Models; and Case Studies and Technical Reports. The Taxonomy discusses six types of life cycle cost models including accounting, cost estimating relationship, simulation, failure-free warranty, reliability, and economic analysis models. One conclusion is that awareness of life cycle costing concepts results in better planning and decision making. (Modified author abstract) GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N75-16014 Polish Academy of Sciences, Warsaw.
IDENTIFICATION OF THE PARAMETERS OF ATTENTION AND RIGIDITY OF VIBRO-ISOLATED MATERIALS
Andrzej Rozycki, Bogdan Rysinski, and Jerzy Wicher 5 Mar. 1973 29 p In POLISH
(Rept-4/1973) Avail: Issuing Activity

Several methods for measuring the damping properties of attenuating materials are presented. One method was investigated which measures both attenuation and rigidity under dynamic conditions, and presents these parameters as a function of the oscillation frequency. Other methods discussed include the energy method, the thermal method, a dynamic loop method, the phase method, and a fading oscillations method. Transl. by M.J.S.

N75-16015*# Boeing Co., Seattle, Wash.
ADVANCED BEADED AND TUBULAR STRUCTURAL PANELS. VOLUME 1: DESIGN AND ANALYSIS
Bruce E. Greene [1974] 90 p refs
(Contract NAS1-10749)
(NASA-CR-132460) Avail: NTIS HC $4.75 CSCL 20K

A study was conducted to exploit the efficiency of curved elements in the design of lightweight structural panels under combined loads of axial compression, inplane shear, and bending. Data cover analytical procedures for optimum panel design, static strength analyses, results of panel design studies, and correlation of theory with test results. Author

N75-16016*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NUMERICAL EVALUATION OF THE SURFACE DEFORMATION OF ELASTIC SOLIDS SUBJECTED TO A HERTZIAN CONTACT STRESS
D. Dowson and B. J. Hamrock 1975 8 p refs To be presented at the Intern. Lubrication Conf., Tokyo, 9-11 Jun. 1975; sponsored by the Japan. Soc. of Lubrication Engr. and the Am. Soc. of Lubrication Engr.
(NASA-TM-X-71649; E-7964) Avail: NTIS HC $3.25 CSCL 20K

The elastic deformation of two ellipsoidal solids in contact and subjected to a Hertzian stress distribution was evaluated numerically as part of a general study of the elastic deformation of such solids in elastohydrodynamic contacts. In the analysis the contact zone is divided into equal rectangular areas and it

is assumed that a uniform pressure is applied over each rectangular area. A study was made of the influence on the size of the rectangular area upon accuracy. The results also indicate how far from the center of the contact one needs to go before elastic deformation becomes insignificant. Author

N75-16017*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE EFFECT OF RING DISTORTIONS ON BUCKLING OF BLUNT CONICAL SHELLS
Walter L. Heard, Jr., Melvin S. Anderson, and Wendell B. Stephens Washington Feb. 1975 33 p refs
(NASA-TN-D-7853; L-9930) Avail: NTIS HC $3.75 CSCL 20K

A rigorous analytical study of cones stiffened by many thin-gage, open-section rings is presented. The results are compared with data previously obtained from uniform pressure tests of the Viking mission flight aeroshell and of the Viking structural prototype aeroshells. A conventional analysis, in which the rings are modeled as discrete rigid cross sections, is shown to lead to large, unconservative strength predictions. A more sophisticated technique of modeling the rings as shell branches leads to much more realistic strength predictions and more accurately predicts the failure modes. It is also shown that if a small initial imperfection proportional to the shape of the buckling mode is assumed, the critical buckling modes from analysis and test are in agreement. However, the reduction in buckling strength from the perfect-shell predictions is small. Author

N75-16018*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ARBITRARILY CURVED AND TWISTED SPACE BEAMS Ph.D. Thesis - Va. Polytech. Inst. and State Univ.
William F. Hunter Dec. 1974 115 p refs
(NASA-TM-X-72185) Avail: NTIS HC $5.25 CSCL 20K

A derivation of the equations which govern the deformation of an arbitrarily curved and twisted space beam is presented. These equations differ from those of the classical theory in that (1) extensional effects are included; (2) the strain-displacement relations are derived; and (3) the expressions for the stress resultants are developed from the strain displacement relations. It is shown that the torsional stress resultant obtained by the classical approach is basically incorrect except when the cross-section is circular. The governing equations are given in the form of first-order differential equations. A numerical algorithm is given for obtaining the natural vibration characteristics and example problems are presented. Author

N75-16019# Aeronautical Research Labs., Melbourne (Australia).
THE FRACTURE TOUGHNESS OF LARGE STRUCTURAL FATIGUE SPECIMENS OF D6ac STEEL
R. Ellis and B. E. Anderson Aug. 1974 26 p refs
(ARL/SM-410) Avail: NTIS HC $3.75

Fracture toughness tests, performed on both compact tension and bend specimens taken from several positions of different thickness in large channel-section fatigue specimens of D6ac steel heat treated to a UTS of 234 to 241 ksi(1610 to 1660 MPa), are described. A small sub-standard compact tension fracture toughness specimen was developed for this investigation and its performance was validated against a larger ASTM standard specimen. Observations are included on the effects of static pre-loading and crack orientation on fracture toughness and reference is made to a possible correlation between fracture toughness and the machining characteristics of the material. Author

N75-16020# California Univ., Livermore. Lawrence Livermore Lab.
STUDY OF PLANE STRESS FRACTURE IN THE LARGE-SCALE PLASTIC YIELDING REGIME
G. E. Tardiff, B. A. Kuhn, and L. A. Heldt (Michigan Technological Univ., Houghton) 11 Apr. 1974 28 p refs Presented at the 8th Natl. Symp. on Fracture Mechanics, Providence, 26 - 28 Aug. 1974 Sponsored by AEC
(UCRL-75610; Conf-740821-1) Avail: NTIS HC $3.75

Independent methods for measuring plane stress fracture resistance in the large-scale plastic yielding regime were tested and were found to give equivalent results. The three methods were the J integral technique, a method based on the increase in compliance that accompanies the development of a plastic zone, and a method based on the direct measurement of the plastic work that must be done to cause fracture. Author (NSA)

N75-16021# California Univ., Berkeley. Lawrence Berkeley Lab.
CHARACTERIZATION OF BRITTLE CRACK INITIATION IN WELDED A-36 AND A-537 STEELS
H. P. Offer Jun. 1974 88 p refs
(Contract W-7405-eng-48)
(LBL-2251) Avail: NTIS HC $4.75

An investigation was made of the fracture toughness of the microstructures in the fusion and heat affected zones and in the normalized plate microstructure of welded low strength structural steels. Testing of each steel was performed at 23, 0, -40 and -75 C for the welded, side grooved specimens and at the same temperatures for two thicknesses of unwelded specimens with and without deep side grooves. Vickers microhardness measurements were made for a strength correlation in all microstructural regions tested. Charpy V-notch and uniaxial tensile tests were performed for the normalized microstructure. The results show that altering microstructure, testing temperature, toughness level, and degree of mechanical constraint has a significant effect on the corresponding fracture characteristics. The most important effect on altering these variables is on the amount of slow, ductile crack propagation before catastrophic, brittle crack propagation. Author

N75-16022# United Kingdom Atomic Energy Authority, Springfields (England). Reactor Fuel Element Labs.
FATIGUE, NOTCH SENSITIVITY AND WORK OF FRACTURE STUDIES ON ISOTROPIC GRAPHITE
J. E. Brocklehurst and R. G. Brown Aug. 1974 32 p refs
(TRG-Rept-2513(S)) Avail: AEC Depository Libraries HC $4.75

Fatigue endurance data from stress cycling tests at room temperature are presented in terms of the ratio of applied stress to the mean stress for static failure. Data from different graphites and modes of testing correlate reasonably well. There is an effect of mean stress level on fatigue endurance, with a biased mean tensile stress producing less fatigue damage than zero mean stress cycles to the same peak stress (with greater stress amplitude). No weakening effect was observed on specimens strength tested after stress cycling. Work of fracture measurements on different types of specimen show reasonably consistent results for all specimens except for circumferentially notched round bars. Both the work of fracture and notch sensitivity tests indicate that there is a limit to the degree of sharpness that can be induced artificially by machine defects. Results are discussed in terms of inherent defect size and separation. Author (NSA)

N75-16023# Sydney Univ. (Australia). Civil Engineering Labs.
EFFECT OF IN-PLANE DEFORMATION ON LATERAL BUCKLING
P. Vacharajittiphan, S. T. Woolcock, and N. S. Trahair Dec. 1973 51 p refs
(PB-236098/0; R-230) Avail: NTIS HC $4.25 CSCL 13B

In the classical analysis of the flexural-torsional buckling of beams, beam-columns and rigid-jointed plane frames, it is assumed that the major axis rigidity is very large, so that the small inplane deformations can be neglected. The effects of the inplane deformations on lateral buckling are investigated for determinate beams and cantilevers, beam-columns, continuous beams and portal frames. This is done by deriving more accurate governing differential equations, and by obtaining closed form or numerical solutions of these. GRA

N75-16024# Kentucky Univ., Lexington. Dept. of Civil Engineering.
CONSTRAINED AND SHEAR MODULI FOR FINITE ELEMENTS
Vincent P. Drnevich Jun. 1974 36 p refs
(PB-235673/1; UKY-TR85-74-CE22) Avail: NTIS HC $3.75 CSCL 08M

The stress-strain matrix is used in finite element analyses

reformulated in terms of constrained and shear moduli. The new formulation uncouples shear and compression and is independent of the relationships of elasticity. Hyperbolic functions are proposed to define equivalent elastic compression and shear moduli for modeling nonlinear soil behavior. Procedures are provided to determine the parameters for the hyperbolic equations from conventional one-dimensional compression and simple shear tests. Compression and shear wave propagation velocities measured in situ are used. Several examples are given for the determination of the hyperbolic parameters from actual soil test data. GRA

N75-16025# Stanford Univ., Calif. Dept. of Applied Mechanics.
THE DYNAMIC RESPONSE OF AN ELASTIC HALF-SPACE WITH AN OVERLYING ACOUSTIC FLUID Interim Report
Bruce E. Bennett and George Herrmann May 1974 22 p refs
(Contract N00014-67-A-0112-0065)
(AD-787036; SUDAM-74-4) Avail: NTIS CSCL 20/11

A class of dynamic problems involving a semi-infinite elastic solid with an overlying semi-infinite acoustic fluid, subjected at the plane interface to arbitrary normal loading is investigated. A method of solution is proposed which reduces the class of problems under study to that in which the fluid is absent. This latter class has received considerable consideration in the past. A specific example is presented for an expanding disk-shaped load including numerical results for the subseismic range.
Author (GRA)

N75-16026# Naval Postgraduate School, Monterey, Calif.
A STUDY OF THE INFLUENCE OF STRESS AND TEMPERATURE ON THE DAMPING CAPACITY OF Mn-Cu ALLOYS FOR SHIP SILENCING APPLICATIONS M.S. Thesis
Norman Anthony Hills Sep. 1974 103 p refs
(AD-787361) Avail: NTIS CSCL 11/6

Mn-Cu alloys develop a high damping capacity after a heat treatment of aging and subsequent quenching. The damping capacity developed is extremely sensitive to aging time at a given temperature or temperature for a fixed time. The effect of stress applied during the heat treatment of the commercial alloy Incramute is significant. A tensile load precludes the development of high damping capacity for the aging times investigated (up to 50 hours in some cases). A compressive load only increases the time required to achieve the maximum damping capacity. A preliminary study of the effect of stress applied during heat treatment of Incramute indicates that the major disruption to development of high damping capacity occurs during the aging portion of the heat treatment. (Modified author abstract) GRA

N75-16027# Naval Postgraduate School, Monterey, Calif.
STRESS CONCENTRATION FACTORS FOR CIRCULAR NOTCHES M.S. Thesis
Lawrence Jerome Smith Jun. 1974 164 p refs
(AD-783784) Avail: NTIS CSCL 20/11

Existing finite element programs PLISOP and PLIMEG are modified and adapted to the successful determination of stress concentration factors for thin elastic bars containing V-shaped round bottom notches and subjected to tensile or bending loads. Accuracy and reliability are demonstrated. Comparisons are made with previous analytical and experimental determinations. The effects of finite bar thickness are discussed. Author (GRA)

N75-16028# Sydney Univ. (Australia). Civil Engineering Labs.
AN INVESTIGATION OF THE STABILITY OF NUMERICAL SOLUTIONS OF BIOT'S EQUATIONS OF CONSOLIDATION
J. R. Booker and J. C. Small Apr. 1974 23 p refs
(PB-236064/2; R-235) Avail: NTIS HC $3.25 CSCL 20K

A finite element formulation based on approximation in the Laplace transform space, is given for Biot's consolidation theory. Various integration schemes are proposed and conditions under which these integration schemes are stable are investigated. The results are illustrated by means of a numerical example. GRA

42 GEOSCIENCES (GENERAL)

N75-16029*# Minnesota Univ., Minneapolis.
DRY HEAT EFFECTS ON SURVIVAL OF INDIGENOUS SOIL PARTICLE MICROFLORA AND PARTICLE VIABILITY STUDIES OF KENNEDY SPACE CENTER SOIL
O. R. Ruschmeyer, I. J. Pflug, R. Gove, and Y. Heisserer [1975] 37 p
(Grant NGL-24-005-160)
(NASA-CR-142042) Avail: NTIS HC $3.75 CSCL 08M

Research efforts were concentrated on attempts to obtain data concerning the dry heat resistance of particle microflora in Kennedy Space Center soil samples. The in situ dry heat resistance profiles at selected temperatures for the aggregate microflora on soil particles of certain size ranges were determined. Viability profiles of older soil samples were compared with more recently stored soil samples. The effect of increased particle numbers on viability profiles after dry heat treatment was investigated. These soil particle viability data for various temperatures and times provide information on the soil microflora response to heat treatment and are useful in making selections for spacecraft sterilization cycles. Author

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography*.

N75-16030*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
PLANNING APPLICATIONS IN EAST CENTRAL FLORIDA Progress Report, 1 Aug. - 31 Oct. 1974
John W. Hannah (Brevard County Planning Dept.), Garland L. Thomas (Brevard County Planning Dept.), Fernando Esparza, Principal Investigators, and James J. Millard 31 Oct. 1974 10 p EREP
(E75-10107; NASA-TM-X-72174) Avail: NTIS HC $3.25 CSCL 08B

There are no author-identified significant results in this report.

N75-16031*# Environmental Research Inst. of Michigan, Ann Arbor.
DEVELOPING PROCESSING TECHNIQUES FOR SKYLAB DATA Monthly Progress Report, Dec. 1974
Richard F. Nalepka, William A. Malila, Principal Investigators, and James P. Morgenstern 15 Jan. 1975 7 p EREP
(Contract NAS9-13280)
(E75-10110; NASA-CR-140921; ERIM-101900-46-L) Avail: NTIS HC $3.25 CSCL 05B

There are no author-identified significant results in this report.

N75-16032*# Environmental Research Inst. of Michigan, Ann Arbor.
OIL POLLUTION DETECTION, MONITORING AND LAW ENFORCEMENT Quarterly Progress Report, Nov. 1974
Robert Horvath, Principal Investigator 22 Jan. 1975 2 p EREP
(Contract NAS9-13281)
(E75-10111; NASA-CR-140922; ERIM-101800-17-P) Avail: NTIS HC $3.25 CSCL 13B

There are no author-identified significant results in this report.

N75-16033*# Rockwell International Science Center, Thousand Oaks, Calif.
IDENTIFICATION AND INTERPRETATION OF TECTONIC FEATURES FROM SKYLAB IMAGERY Monthly Report, Nov. 1974
Monem Abdel-Gawad, Principal Investigator 30 Dec. 1974 2 p EREP

(Contract NAS9-14440)
(E75-10112; NASA-CR-141943; SC5007.1MR) Avail: NTIS HC $3.25 CSCL 08G

The author has identified the following significant results. S190-B imagery confirmed previous conclusions from S190-A that the Garlock fault does not extend eastward beyond its known termination near the southern end of Death Valley. In the Avawatz Mountains, California, two faults related to the Garlock fault zone (Mule Spring fault and Leach Spring fault) show evidence of recent activity. There is evidence that faulting related to Death Valley fault zone extends southeastward across the Old Dad Mountains. There, the Old Dad fault shows evidence of recent activity. A significant fault lineament has been identified from McCullough Range, California southeastward to Eagle Tail Mountains in southwestern Arizona. The lineament appears to control tertiary and possible cretaceous intrusives. Considerable right lateral shear is suspected to have taken place along parts of this lineament.

N75-16034*# Rockwell International Science Center, Thousand Oaks, Calif.
IDENTIFICATION AND INTERPRETATION OF TECTONIC FEATURES FROM SKYLAB IMAGERY Monthly Report, Dec. 1974
Monem Abdel-Gawad, Principal Investigator 31 Dec. 1974 2 p EREP
(Contract NAS9-14440)
(E75-10113; NASA-CR-141944; SC5007.3MR) Avail: NTIS HC $3.25 CSCL 08G

The author has identified the following significant results. A remarkable system of northwest and west-northwest trending faults was found to continue from eastern California into southwestern Arizona. The most significant is a fault belt which extends from west of Marble Mountains (southeastern California) across the Colorado River at Parker Valley towards Silver Bell Mountains, southern Arizona.

N75-16035*# South Dakota State Univ., Brookings. Remote Sensing Inst.
DEVELOP TECHNIQUES AND PROCEDURES, USING MULTISPECTRAL SYSTEMS, TO IDENTIFY FROM REMOTELY SENSED DATA THE PHYSICAL AND THERMAL CHARACTERISTICS OF PLANTS AND SOIL Monthly Progress Report, Dec. 1974
Victor I. Myers, Principal Investigator 20 Jan. 1975 2 p EREP
(Contract NAS9-13337)
(E75-10114; NASA-CR-141347) Avail: NTIS HC $3.25 CSCL 05B

There are no author-identified significant results in this report.

N75-16036*# Agricultural Research Service, Weslaco, Tex.
A STUDY OF THE EARLY DETECTION OF INSECT INFESTATIONS AND DENSITY/DISTRIBUTION OF HOST PLANTS Progress Report, Aug. 1974
William G. Hart, Principal Investigator, Sammy J. Ingle, and M. R. Davis 31 Aug. 1974 2 p EREP
(NASA Order T-4109-B)
(E75-10115; NASA-CR-141950; PR-19) Avail: NTIS HC $3.25 CSCL 06C

There are no author-identified significant results in this report.

N75-16037*# Agricultural Research Service, Weslaco, Tex.
A STUDY OF THE EARLY DETECTION OF INSECT INFESTATIONS AND DENSITY/DISTRIBUTION OF HOST PLANTS Progress Report, Jul. 1974
William G. Hart, Principal Investigator, Sammy J. Ingle, and M. R. Davis 31 Jul. 1974 2 p EREP
(NASA Order T-4109-B)
(E75-10116; NASA-CR-141951; PR-18) Avail: NTIS HC $3.25 CSCL 06C

There are no author-identified significant results in this report.

N75-16038*# Environmental Research Inst. of Michigan, Ann Arbor.
STUDY OF RECREATIONAL LAND AND OPEN SPACE USING SKYLAB IMAGERY Monthly Progress Report, Dec. 1974
Irvin J. Sattinger, Principal Investigator 21 Jan. 1975 2 p EREP
(Contract NAS9-13283)
(E75-10117; NASA-CR-141952; ERIM-103300-42-L) Avail: NTIS HC $3.25 CSCL 08B

There are no author-identified significant results in this report.

N75-16039*# Geological Survey, Reston, Va.
EVALUATION OF ERTS-1 DATA APPLICATIONS TO GEOLOGIC MAPPING, STRUCTURAL ANALYSIS AND MINERAL RESOURCE INVENTORY OF SOUTH AMERICA WITH SPECIAL EMPHASIS ON THE ANDES MOUNTAIN REGION Bimonthly Progress Report, 1 Nov. - 31 Dec. 1973
William D. Carter, Principal Investigator 2 Feb. 1974 10 p refs Repr. from Space Shuttle Payloads, v. 30, 1973 p 143-153 Sponsored by NASA ERTS
(E75-10118; NASA-CR-141953) Avail: NTIS HC $3.25 CSCL 08G

There are no author-identified significant results in this report.

N75-16040*# Geological Survey, Reston, Va.
EVALUATION OF ERTS-1 DATA APPLICATIONS TO GEOLOGIC MAPPING, STRUCTURAL ANALYSIS AND MINERAL RESOURCE INVENTORY OF SOUTH AMERICA WITH SPECIAL EMPHASIS ON THE ANDES MOUNTAIN REGION Bimonthly Progress Report, 1 Sep. - 31 Oct. 1973
William D. Carter, Principal Investigator 28 Jan. 1974 4 p ERTS
(E75-10119; NASA-CR-141954) Avail: NTIS HC $3.25 CSCL 08G

The author has identified the following significant results. A color composite of image E1010-14035, dated 2 August 1972, covers the west central Bolivian Altiplano near Salar de Coipasa. It clearly shows the distribution of surface water and scant patches of vegetation. The Salar de Coipasa is the largest body of water in the area, about 130 sq km of dark blue fresh water. A lighter blue area south of the lake suggests a thin cover of highly saline water superposed on salt beds. The scattered vegetation patches are presumed to be native grasses, lichens, and possibly Indian potato and maiz areas. A detailed study has been made of the scene which provides 12 different interpretive overlays including geology, volcanology, soils, hydrology, and relative permeability. It was found that color composites provide at least 40% more information that do black and white renditions. An excellent example of change detection was provided by image E1244-14051, dated 24 March 1973. Water in the Salar de Coipasa had more than doubled as a result of the rains of the Bolivian winter, which generally occur in the February-March period. The Salars are excellent and highly sensitive moisture indicators in this highly arid region.

N75-16041*# Bureau of Land Management, Denver, Colo.
PREDICT EPHEMERAL AND PERENNIAL RANGE QUANTITY AND QUALITY DURING NORMAL GRAZING SEASON Final Report, 1 Jul. 1972 - 30 Jun. 1973
R. Gordon Bentley, Jr., Principal Investigator 31 Mar. 1974 87 p refs Original contains color illustrations. Orginal contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-70243-AG)
(E75-10120; NASA-CR-141955) Avail: NTIS HC $4.75 CSCL 08F

The author has identified the following significant results. Collection and update of resource inventory data has historically been a difficult, time consuming task. Accurate resource data is necessary as a basis for wise management decisions made by a resource management agency such as the Bureau of Land Management. Black and white and color infrared composites of

ERTS satellite imagery at 1:1,000,000 and enlarged scales can be used as data gathering tools. No investment in expensive sophisticated equipment is necessary. A photointerpreter can map boundaries of soils, plant communities, levels of forage production, areas revegetated by man, and areas burned by wildlife directly from satellite imagery. The ERTS system of producing and distributing imagery must be improved greatly before satellite imagery can be useful to the resource manager.

N75-16042*# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia). Forestry and Timber Bureau.
A STUDY OF THE USEFULNESS OF SKYLAB EREP DATA FOR EARTH RESOURCES STUDIES IN AUSTRALIA
N. H. Fisher, Principal Investigator 29 Jan. 1975 1 p Sponsored by NASA EREP
(E75-10121; NASA-CR-141975) Avail: NTIS HC $3.25 CSCL 05B

There are no author-identified significant result in this report.

N75-16043*# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia). Mineral Research Labs.
A STUDY OF THE USEFULNESS OF SKYLAB EREP DATA FOR EARTH RESOURCES STUDIES IN AUSTRALIA Quarterly Report
N. H. Fisher and K. L. Burns, Principal Investigators 31 Jan. 1975 1 p Sponsored by NASA EREP
(E75-10122; NASA-CR-141976) Avail: NTIS HC $3.25 CSCL 05B

The author has identified the following significant results. Preliminary results show that the high resolution imagery has, potentially, an operational role in geological surveying and the design of major engineering works, and is much more promising in this regard than the low resolution Skylab and ERTS-1 imagery.

N75-16044*# Earth Satellite Corp., Berkeley, Calif.
PLAN FOR THE UNIFORM MAPPING OF EARTH RESOURCES AND ENVIRONMENTAL COMPLEXES FROM SKYLAB IMAGERY Progress Report, 1 Apr. 1974 - 31 Jan. 1975
Charles E. Poulton, Principal Investigator 31 Jan. 1975 3 p EREP
(Contract NAS9-13286)
(E75-10123; NASA-CR-141977) Avail: NTIS HC $3.25 CSCL 08B

There are no author-identified significant results in this report.

N75-16045*# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).
A STUDY OF THE USEFULNESS OF SKYLAB EREP DATA FOR EARTH RESOURCES STUDIES IN AUSTRALIA Quarterly Report, Nov. 1974 - Jan. 1975
N. H. Fisher, C. Maffi, C. J. Simpson, and W. J. Perry, Principal Investigators Jan. 1975 3 p Sponsored by NASA EREP
(E75-10124; NASA-CR-141978) Avail: NTIS HC $3.25 CSCL 05B

There are no author-identified significant results in this report.

N75-16046*# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia). Div. of Land Use Research.
A STUDY OF THE USEFULNESS OF SKYLAB EREP DATA FOR EARTH RESOURCES STUDY IN AUSTRALIA
N. H. Fisher, Principal Investigator [1975] 1 p Sponsored by NASA EREP
(E75-10125; NASA-CR-141957) Avail: NTIS HC $3.25 CSCL 05B

The author has identified the following significant results. Cursory examination shows that the Skylab photos alone would provide all the pictorial information needed for surveys in arid and semiarid regions according to the pattern of the Alice Springs survey (mapping at a scale of 1:1 million).

N75-16047*# Nevada Univ., Reno. Mackay School of Mines.
THE GREAT BASIN INVESTIGATION Monthly Progress Report
Jack G. Quade, Principal Investigator [1975] 2 p EREP
(Contract NAS9-13274)
(E75-10126; NASA-CR-141979) Avail: NTIS HC $3.25 CSCL 08E

There are no author-identified significant results in this report.

N75-16048*# Department of the Environment, Ottawa (Ontario). Applied Hydrology Div.
WATER SURVEY OF CANADA: APPLICATION FOR USE OF ERTS-A FOR RETRANSMISSION OF WATER RESOURCES DATA Semiannual Progress Report, Jul. - Dec. 1974
R. A. Halliday, Principal Investigator and I. A. Reid Jan. 1975 9 p Sponsored by NASA ERTS
(E75-10127; NASA-CR-141980) Avail: NTIS HC $3.25 CSCL 08H

The author has identified the following significant results. Water resources data including water level, water velocity, precipitation, air temperature, ice-out indicator, data collection platform battery check and water stage recorder clock operation have been transmitted from remote areas in Canada using the ERTS Data Collection System. The system has met all requirements. The suitability of satellite retransmission has been demonstrated. The present network will be expanded to 28 in 1975.

N75-16049*# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.
INVENTORY OF FOREST AND RANGELAND RESOURCES, INCLUDING FOREST STRESS Bimonthly Progress Report, 16 Nov. 1974 - 15 Jan. 1975
Robert C. Aldrich, Frederick P. Weber, and Richard S. Driscoll, Principal Investigators 21 Jan. 1975 10 p EREP
(NASA Order T-4106-B)
(E75-10128; NASA-CR-141999; BMPR-15) Avail: NTIS HC $3.25 CSCL 02F

There are no author-identified significant results in this report.

N75-16050*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
DATA COLLECTION SYSTEM: EARTH RESOURCES TECHNOLOGY SATELLITE-1
Saul Cooper, ed. (Army Corps of Engineers) and Philip T. Ryan, ed. Washington 1975 127 p refs Proc. held at Wallops Island, Va., 30-31 May 1973
(NASA-SP-364; LC-74-600160) Avail: NTIS HC $5.75 CSCL 05B

Subjects covered at the meeting concerned results on the overall data collection system including sensors, interface hardware, power supplies, environmental enclosures, data transmission, processing and distribution, maintenance and integration in resources management systems. For individual titles, see N75-16051 through N75-16066.

N75-16051* Geological Survey, Harrisburg, Pa.
THE USE OF EARTH RESOURCES TECHNOLOGY SATELLITE FOR RELAYING HYDROLOGIC DATA IN THE DELAWARE RIVER BASIN
Richard W. Paulson *In* NASA. Wallops Station Data Collection System 1975 p 5-16 (For availability see N75-16050 07-43) CSCL 08H

The earth resources data acquisition systems on ERTS are providing data from the earth's surface that have great potential for resources management. The Data Collection System is providing water resources data several times a day from widely scattered locations in the Delaware River Basin. Within the constraints of an experimental test, the data are being processed and released to water resources agencies in near-real time. The results of ERTS investigations have shown that there is a potential application for satellite-borne systems for earth resources data acquisition. It is becoming clear that the solutions to many natural resource problems can be found faster and more efficiently with the help of data acquisition systems such as those on the ERTS observatory. Under operational conditions, low cost battery-operated DCP's could provide the Geological Survey with data

from a large number of field instruments. These data could be used by the Geological Survey to monitor the operational status of field instrumentation and could be used by cooperating agencies to monitor a wide range of earth resources conditions. Under operational conditions, the data flow could be in real time. The delay from time of data acquisition by ERTS to the time of data availability to data users could be reduced to seconds, rather than the present lag time of a few hours. Author

N75-16052* Department of the Environment, Ottawa (Ontario).
DATA RETRANSMISSION FROM WATER SURVEY OF CANADA GAUGING STATIONS USING THE ERTS DATA COLLECTION SYSTEM
Robert A. Halliday *In* NASA. Wallops Station Data Collection System 1975 p 17-20 (For availability see N75-16050 07-43) CSCL 08H

Nine sites were selected for installation of Data Collection Platforms (DCPs) with the objective of obtaining one near real time water level reading a day from each site. Also the dependability, costs and other aspects of the system could be studied and decisions made with respect to the feasibility of operating a much larger network of DCPs. The number of transmissions received each day from the gauging stations varies from a maximum of 26 to 12 and a minimum of 10 to 3, depending on the location. Quality checks of data have indicated that the data are good. None of the nine DCPs have failed once they have been successfully activated. The experience with the ERTS data collection system has been excellent. The DCP appears to be a rugged, reliable piece of equipment. The ones installed at water survey sites have withstood temperatures less than -40 C and the antennas have withstood wind speeds of over 80 kph (50 mph) and snow loads of 0.6 m (2 ft). Author

N75-16053* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MOBILE DATA BUOY SYSTEM
Rex A. Morton *In its* Data Collection System 1975 p 21-30 (For availability see N75-16050 07-43) CSCL 08H

The Mobile Data Buoy System was conceived to serve the users requirement for obtaining water quality parameters from two separate watershed systems. In view of the cost constraints of the ERTS progjam it was obvious that the network of 10 sampling-stations required could not be of the fixed installation type; therefore, it was decided to go to a system of battery powered buoys of a size that could be used in one watershed system for a period of time and then moved to another by use of a relatively small 6.7 m (22 foot) boat. The basic idea of the water quality measurement program was to establish the water quality pattern of change from the headwaters of the watersheds to and through the Mobile Bay. This would allow the investigator to develop a good picture of the state's major water resources and the pressures from pollution that are being imposed. At this point in deployment of this mobile system of buoys, it is too early to put a quantitative value on the system, however it appears less expensive than known fixed installations as to first cost. It has a basic advantage in that it can be moved, at very little expense, to alternate sites where it is desired to obtain water quality data. It is to be noted this buoy system which covers a 80 Km (50 mile) stretch of the Black Warrior River and then skips down 483 Km (300 miles) to Mobile Bay for the next measurements would not be feasible unless there is a satellite to collect and relay the data. Author

N75-16054* Geological Survey, Menlo Park, Calif. National Center for Earthquake Research.
PERFORMANCE OF THE ERTS-1 DCS IN A PROTOTYPE VOLCANO SURVEILLANCE SYSTEM
Peter L. Ward *In* NASA. Wallops Station Data Collection System 1975 p 31-44 (For availability see N75-16050 07-43) CSCL 08F

A prototype volcano surveillance system has been installed on 15 volcanoes in four states and four countries. The need for this system, the techniques used, the method of implementation, the major problems, the results, and the future seen for such a system are briefly reviewed. Author

N75-16055* Corps of Engineers, Waltham, Mass.
USE OF ERTS-1 DCS IN THE MANAGEMENT AND CONTROL OF WATER RESOURCES SYSTEMS
Joseph W. Finegan, Jr. *In* NASA. Wallops Station Data Collection System 1975 p 45-52 (For availability see N75-16050 07-43) CSCL 08H

The ERTS-1 experimental hydrologic Data Collection Platform System that has been established at the New England Division (NED), the reasons for getting involved with the experiment, some of the initial problems associated with the data collection hardware, and a preliminary conclusion based on operating experiences are reviewed. The New England Region includes the states of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island and Connecticut. The entire area consists of approximately 97,000 sq. km. (60,000 square miles), half of which is in the state of Maine. The limits of the NED are all of Maine, New Hampshire and Vermont to the western limits of the Connecticut River basin, Massachusetts, Connecticut to the western edge of the Housatonic River basin and Rhode Island. All reservoirs have flood control as a primary purpose. Other uses include water supply, recreation and low flow augmentation. However, none of the reservoirs are presently operated for hydroelectric power, navigativn, or irrigation purposes. Basically then, flood control regulation is NED's primary concern. Author

N75-16056* National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
ERTS-1 DCS TECHNICAL SUPPORT PROVIDED BY WALLOPS STATION
Roger Smith *In its* Data Collection System 1975 p 53-56 (For availability see N75-16050 07-43) CSCL 14B

Wallops Station accepted the tasks of providing ground truth to several ERTS investigators, operating a DCP repair depot, designing and building an airborne DCP Data Acquisition System, and providing aircraft underflight support for several other investigators. Additionally, the data bank is generally available for use by ERTS and other investigators that have a scientific interest in data pertaining to the Chesapeake Bay area. Working with DCS has provided a means of evaluating the system as a data collection device possibly applicable to ongoing Earth Resources Program activities in the Chesapeake Bay area as well as providing useful data and services to other ERTS investigators. The two areas of technical support provided by Wallops, ground truth stations and repair for DCPs, are bridfly discussed. Author

N75-16057* Geological Survey, Bay Saint Louis, Miss.
USDI DCS TECHNICAL SUPPORT: MISSISSIPPI TEST FACILITY
Duane M. Preble *In* NASA. Wallops Station Data Collection System 1975 p 57-64 (For availability see N75-16050 07-43) CSCL 14B

The objective of the technical support effort is to provide hardware and data processing support to DCS users so that application of the system may be simply and effectively implemented. Technical support at Mississippi Test Facility (MTF) is concerned primarily with on-site hardware. The first objective of the DCP hardware support was to assure that standard measuring apparatus and techniques used by the USGS could be adapted to the DCS. The second objective was to try to standardize the miscellaneous variety of parameters into a standard instrument set. The third objective was to provide the necessary accessories to simplify the use and complement the capabilities of the DCP. The standard USGS sites have been interfaced and are presently operating. These sites are stream gauge, ground water level and line operated quality of water. Evapotranspiration, meteorological and battery operated quality of water sites are planned for near future DCP operation. Three accessories which are under test or development are the Chu antenna, solar power supply and add-on memory. The DCP has proven to be relatively easy to interface with many monitors. The large antenna is awkward to install and transport. The DCS has met the original requirements well; it has and is proving that an operation, satellite-based data collection system is feasible. Author

N75-16058* National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.

AUXILIARY DCP DATA ACQUISITION SYSTEM
Robert V. Snyder *In its* Data Collection System 1975 p 65-72 (For availability see N75-16050 07-43)
CSCL 05B

An airborne DCP Data Aquisition System has been designed to augment the ERTS satellite data recovery system. The DCP's are data collection platforms located at pertinent sites. With the appropriate sensors they are able to collect, digitally encode and transmit environmental parameters to the ERTS satellite. The satellite in turn relays these transmissions to a ground station for processing. The satellite is available for such relay duty a minimum of two times in a 24-hour period. The equipment is to obtain continuous DCP data during periods of unusual environmental activity--storms, floods, etc. Two circumstances contributed to the decision to design such a system; (1) Wallops Station utilizes surveillance aircraft in support of rocket launches and also in support of earth resources activities; (2) the area in which Wallops is located, the Delaware and Chesapeake Bay areas, are fertile areas for DCP usage. Therefore, by developing an airborne DCP receiving station and installing it on aircraft more continuous DCP data can be provided from sites in the surrounding areas at relatively low cost. Author

N75-16059* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPACE DATA RELAY SYSTEMS
Charles E. Cote *In its* Data Collection System 1975 p 73-82 refs (For availability see N75-16050 07-43)
CSCL 17B

Significant progress has been achieved in simplifying platform concepts through random access techniques. This is particularly important in applications such as balloons where weight is critical. In applications, where weight restriction may not be a problem, the concept lends itself to uncomplicated designs and low cost. Nevertheless, ordered systems offer inherent advantages in managing data flow which justifies their use. With continuing improvements in technology, particularly low power receivers, ordered systems should become quite competitive with random systems for many applications. Author

N75-16060* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ERTS-1 DATA COLLECTION SYSTEM: STATUS AND PERFORMANCE
J. Earle Painter *In its* Data Collection System 1975 p 83-96 (For availability see N75-16050 07-43)
CSCL 17B

The Data Collection System flown on the first Earth Resources Technology Satellite (ERTS-1) relays earth resources data from remotely located in-situ sensors to Goddard Space Flight Center. Data is received at Goddard at least twice each day from every sensor installation and is distributed to users (who operate the sensors and transmitters) by mail and teletype. The system consists of a data formatting and transmitting unit, called the Data Collection Platform (DCP), a receiver and a retransmitter aboard ERTS-1; and receiving, demodulating and decoding equipment located at the Goldstone, California and Goddard data acquisition stations. Data is transmitted from the data acquisition stations to the ERTS Control Center at Goddard, then to the NASA (ERTS) Data Processing Facility (NDPF) where it is processed and distributed to users. Experience to date indicates that the design of the ERTS-1 Data Collection System is adequate for operational use for 50% of the users and, with minor modifications, could meet the requirements of 75%. Some users will have to augment the system by other data collection techniques to meet their operational requirements. Author

N75-16061* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A SUMMARY OF ERTS-1 DATA COLLECTION SYSTEM APPLICATIONS
Vincent V. Salomonson *In its* Data Collection System 1975 p 97-100 (For availability see N75-16050 07-43)
CSCL 17B

Geographically, applications were made over nearly the entire area where direct readout could be accomplished using the data acquisition stations in the ERTS-1 system. The extreme areas included Iceland, the Canadian Arctic, Alaska, Hawaii and Central America. In the discipline sense the majority of applications were in the water resources area with other applications being formally and informally reported in meteorology, oceanography, volcano surveillance and forestry. Installation and maintenance of the data collection platforms, as is true with nearly all new systems, was not accomplished without difficulty. On the whole, however, it has gone well enough so that it is agreed that it is a system which is amenable to installation in a variety of physical situations and the installation is accomplished with an ease commensurate with eventual use in an operational system. Author

N75-16062* Geological Survey, Washington, D.C.
USDI REQUIREMENTS AND PROGRAMS
John M. DeNoyer *In* NASA. Wallops Station Data Collection System 1975 p 101-104 (For availability see N75-16050 07-43)
CSCL 05A

Interior Department plans for the utilization of data collection systems such as the one on ERTS-1 and others scheduled for future use are very briefly discussed. The savings offerred in manpower, acquisition and dissemination of useful data, and the operational potential of data collection systems are described. Author

N75-16063* Corps of Engineers, Washington, D.C.
US ARMY CORPS OF ENGINEERS REQUIREMENTS AND PROGRAMS
John Jarman *In* NASA. Wallops Station Data Collection System 1975 p 105-106 (For availability see N75-16050 07-43)
CSCL 05A

Plans by the Corps of Engineers to utilize data collection systems to support their mission of development, utilization, and conservation of the water resources of the Nation, flood control, water management, hydroelectric power, maintenance of navigable waterways, reservoir construction, and river basin control are briefly addressed. A.L.

N75-16064* National Weather Service, Silver Spring, Md.
NOAA REQUIREMENTS AND PROGRAMS
Allen F. Flanders *In* NASA. Wallops Station Data Collection System 1975 p 107-114 (For availability see N75-16050 07-43)
CSCL 05A

Service programs in NOAA that contemplate using the Geostationary Operational Environmental Satellite (GEOS) Data Collection System (DCS) are considered. The GEOS DCS will be operated by the National Environmental Satellite Service of NOAA as an integral part of the national operation environmental satellite program. This plan is concerned with that part of the GEOS program connected with collection and relay of data from remote locations. Service programs include: (1) hydrological data collection; (2) oceanographic data collection; (3) marine observations from data buoys; (4) Tsunami warning service; and (5) meteorological service. A.L.

N75-16065* Environmental Protection Agency, Rockville, Md.
EPA REQUIREMENTS AND PROGRAMS
John D. Koutsandreas *In* NASA. Wallops Station Data Collection System 1975 p 115-120 (For availability see N75-16050 07-43)
CSCL 05A

The proposed ERTS-DCS system is designed to allow EPA the capability to evaluate, through demonstrable hardware, the effectiveness of automated data collection techniques. The total effectiveness of any system is dependent upon many factors which include equipment cost, installation, maintainability, logistic support, growth potential, flexibility and failure rate. This can best be accomplished by installing the system at an operational environmental control agency (CAMP station) to insure that valid data is being obtained and processed. Consequently, it is imperative that the equipment interface must not compromise the validity of the sensor data nor should the experimental system effect the present operations of the CAMP station. Since both the system which is presently in use and the automatic system would be in operation in parallel, conformation and comparison are readily obtained. Author

N75-16066* National Aeronautics and Space Administration, Washington, D.C.
NASA REQUIREMENTS AND PROGRAMS
Charles W. Mathews *In its* Data Collection System 1975 p 721-132 (For availability see N75-16050 07-43)
CSCL 05A

Conference recommendations for NASA consideration were: (1) continued operation of ERTS-1 for DCS purposes, even after the imaging sensors have ceased to function; and (2) Interagency Coordination Committee on Earth Resources Survey Program undertake study of the potential for further development of DCS that will lead to the initiation of an operational system to meet national and international requirements. Author

N75-16067*# Bethune-Cookman Coll., Daytona Beach, Fla.
REMOTE SENSING BY ERTS SATELLITE OF VEGETATIONAL RESOURCES BELIEVED TO BE UNDER POSSIBLE THREAT OF ENVIRONMENTAL STRESS Annual Report
Premsukh Poonai, Walter J. Floyd, and Royce Hall [1974] 23 p refs Original contains color illustrations
(Grant NGR-10-022-001)
(NASA-CR-142008) Avail: NTIS HC $3.25 CSCL 08F

The distribution of natural vegetation types on North Merritt Island, Florida, was studied by analysis of ERTS multispectral scanner data on the image-100 computer system. The boundaries of six distinct plant associations were located on photos made on the image analyzer, with an insignificant mean error of -24.38 meters. The six plant associations are described; each had a characteristic spectral signature. The difference in average reflectance grey level between the lowest of the four spectral scanning bands and the highest spectral scanning band for the six vegetation types was determined. The decreasing trend of the differences is strongly negatively correlated with height of land. Author

N75-16068*# Stanford Research Inst., Menlo Park, Calif.
STUDY OF TIME-LAPSE PROCESSING FOR DYNAMIC HYDROLOGIC CONDITIONS Final Report, Sep. 1972 - Sep. 1974
Sidney M. Serebreny, W. E. Evans, and E. J. Wiegman Nov. 1974 112 p
(Contract NAS5-21841; SRI Proj. 2165)
(NASA-CR-139159) Avail: NTIS HC $5.25 CSCL 05B

The usefulness of dynamic display techniques in exploiting the repetitive nature of ERTS imagery was investigated. A specially designed Electronic Satellite Image Analysis Console (ESIAC) was developed and employed to process data for seven ERTS principal investigators studying dynamic hydrological conditions for diverse applications. These applications include measurement of snowfield extent and sediment plumes from estuary discharge, Playa Lake inventory, and monitoring of phreatophyte and other vegetation changes. The ESIAC provides facilities for storing registered image sequences in a magnetic video disc memory for subsequent recall, enhancement, and animated display in monochrome or color. The most unique feature of the system is the capability to time lapse the imagery and analytic displays of the imagery. Data products included quantitative measurements of distances and areas, binary thematic maps based on monospectral or multispectral decisions, radiance profiles, and movie loops. Applications of animation for uses other than creating time-lapse sequences are identified. Input to the ESIAC can be either digital or via photographic transparencies. Author

N75-16069*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
A PROCEDURE FOR AUTOMATED LAND USE MAPPING USING REMOTELY SENSED MULTISPECTRAL SCANNER DATA
Sidney L. Whitley Washington Jan. 1975 49 p refs Original contains color illustrations
(NASA-TR-R-434; JSC-S-406) Avail: NTIS HC $3.75 CSCL 08B

A system of processing remotely sensed multispectral scanner data by computer programs to produce color-coded land use maps for large areas is described. The procedure is explained, the software and the hardware are described, and an analogous example of the procedure is presented. Detailed descriptions of the multispectral scanners currently in use are provided together with a summary of the background of current land use mapping techniques. The data analysis system used in the procedure and the pattern recognition software used are functionally described. Current efforts by the NASA Earth Resources Laboratory to evaluate operationally a less complex and less costly system are discussed in a separate section. Author

N75-16070# California Univ., Berkeley. Petroleum Engineering Lab.
EFFECT OF STRESS ON PERMEABILITY OF COAL Final Report, 24 Aug. 1971 - 30 Jun. 1974
W. H. Somerton, I. M. Soylemezoglu, and R. C. Dudley Apr. 1974 62 p refs
(Contract DI-BM-HO-122027)
(PB-235854/7; BM-OFR-45-74) Avail: NTIS HC $4.25 CSCL 08I

The permeabilities of three types of bituminous coals were measured under several stress conditions which were to simulate possible states of stress in underground environments to depths of 2,000 feet. Nitrogen and methane were flowed in the axial direction. Sonic velocities were measured concurrently with permeability tests, and dynamic and static deformation moduli and bulk and pore compressibilities were determined. The study found that the permeabilities of different samples of the same coal varied over a wide range, that permeabilities decreased by one to two orders of magnitude with increasing stress, and that the permeability of coal is dependent on previous loading and unloading of the sample. GRA

N75-16071# Bureau of Mines, Anchorage, Alaska. Field Operation Center.
NATURAL GAS FIELDS, COOK INLET BASIN, ALASKA Open File Report
Donald P. Blasko Apr. 1974 34 p refs
(PB-235767/1; BM-OFR-35-74) Avail: NTIS HC $3.75 CSCL 21D

Locations of gas fields within the Cook Inlet area, extent of development of individual fields, estimated recoverable reserves and production, and an analysis of the natural gas from each field are given. GRA

N75-16072# Texas Univ., Austin.
BASIC RESEARCH NEEDS FOR TERTIARY OIL RECOVERY: PROCEEDINGS OF A NATIONAL SCIENCE FOUNDATION WORKSHOP
R. S. Schechter and W. H. Wade 1974 61 p refs Presented at the Natl. Sci. Found. Workshop, Austin, Tex., 26-27 Jun. 1974 Sponsored in part by NAS-NRC
(Grant NSF GP-44165)
(PB-236726/6) Avail: NTIS HC $4.25 CSCL 08I

Proceedings of a workshop on basic research needs for tertiary oil recovery are presented. Topic areas cover: Low interfacial tensions and residual oil; behavior or polymer in porous media; structure of micellar solutions; adsorption of surfactants on reservoir rock; surfactant floods; distribution of wettability and oil recovery; measurement of oil in place; and thermal recovery. GRA

N75-16427* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EARTH OBSERVATIONS
In its Significant Accomplishments in Sci. and Technol. 1975 p 179-233 (For availability see N75-16422 07-88)
CSCL 08G

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N75-16073*+ National Aeronautics and Space Administration, Washington, D.C.

ENERGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 2

Nov. 1974 154 p

(NASA-SP-7043(02)) Avail: NTIS HC $4.00 CSCL 10B

This bibliography lists 405 reports, articles, and other documents introduced into the NASA Scientific and Technical Information System from April 1, 1974 through June 30, 1974. Author

N75-16074# Maryland Univ., College Park. Dept. of Mechanical Engineering.

SOLAR HEATING AND COOLING FOR BUILDINGS WORKSHOP. PART 2: PANEL SESSIONS, MARCH 23

Redfield Allen Apr. 1974 66 p Workshop held at Washington, D. C., 21-23 Mar. 1973

(Grant NSF GI-32488)

(NSF/RA/N-74-014) Avail: NTIS HC $4.25

Panel discussions of the broader aspects of solar heating and cooling, which provided for programmed interaction among researchers, and architectural, manufacturing, marketing, professional-society, governmental, and user sectors are presented. The following major topics were discussed: (1) solar building technology, including solar heating and cooling systems, energy conservation, and hot water heating; (2) NSF solar heating and cooling for buildings program, including NSF policy in industry and technology assessment; (3) industrial activities; and (4) related building activities, such as, planning, land development, architecture, and utilities. J.M.S.

N75-16075*# Kanner (Leo) Associates, Redwood City, Calif.

INSTRUCTIONS FOR THE FLS AEROMOTOR

F. L. Smidth Washington NASA Jan. 1975 28 p Transl. into ENGLISH from the Danish report Memo-7050

(Contract NASw-2481)

(NASA-TT-F-16138; Memo-7050) Avail: NTIS HC $3.75 CSCL 10A

A comprehensive study of the complete system necessary for the conversion of wind power to electrical power is reported. Complete descriptions of the propeller, gear system, dynamo, starter propeller, and braking mechanism are given, as they relate to the system manufactured by F.L. Smidth and Co. of Denmark. Complete instructions for the operation and maintenance of the system are given. The safety systems and an overall view of the system's operation are also presented. Diagrams showing the entire system in detail are included. Author

N75-16076# Committee on Interior and Insular Affairs (U. S. Senate).

AN ASSESSMENT AND ANALYSIS OF THE ENERGY EMERGENCY

Benjamin Cooper Washington GPO 1973 22 p refs Staff analysis prepared for Comm. on Interior and Insular Affairs pursuant to S. Res. 45, 93d Congr., 1st Sess., 4 Dec. 1973

(GPO-25-382) Avail: Comm. on Interior and Insular Affairs

The background and conditions which led to the energy supply shortages (late 1973) are analyzed along with the urgent need for action to minimize the impact of these shortages. Strict motor gasoline rationing is suggested for increased energy savings. F.O.S.

N75-16077# Committee on Interior and Insular Affairs (U. S. Senate).

MARKET PERFORMANCE AND COMPETITION IN THE PETROLEUM INDUSTRY, PART 1

Washington GPO 1974 473 p refs Hearings pursuant to S. Res. 45 before Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess., 28-29 Nov. 1973

(GPO-28-503) Avail: Comm. on Interior and Insular Affairs

The structure and operations of the oil and gas industries were examined to determine if they operate in a competitive manner, in the best interests of the country. The shipment during the energy crisis of home heating oil from the Houston-Lake Charles area refineries to the North Eastern States and the Upper Plains States is discussed along with the diesel fuel shortage of Metro in the District of Columbia. The development of the Alaskan resources, crude oil production, refining industry, and marketing are also discussed. F.O.S.

N75-16078*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

LEAD-OXYGEN dc POWER SUPPLY SYSTEM Patent Application

William J. Britz, William A. Boshers, and James J. Kaufmann, inventors (to NASA) Filed 27 Dec. 1974 21 p

(NASA-Case-MFS-23059-1; US-Patent-Appl-SN-537024) Avail: NTIS HC $3.25 CSCL 10C

A pollution-free, closed-loop electrical power system using a lead-oxygen battery to supply power for lightweight vehicles is described. The battery system is completely sealed and no outgassing occurs during operation. The system consists of the lead-oxygen battery, a positive charging grid, a conventional negative terminal, a positive discharging electrode, and a Teflon membrane member coated with a catalyst. The system is contained in an atmosphere of oxygen which is admitted to the cell through the Teflon membrane. Oxygen is given off during the charging cycle of the battery and is compressed in a storage tank for re-use during each duty cycle thus providing a closed system in which contamination is minimized and a long-life cycle is maintained. NASA

N75-16079*# Honeywell, Inc., Minneapolis, Minn.

DYNAMIC CONVERSION OF SOLAR GENERATED HEAT TO ELECTRICITY

J. C. Powell, E. Fourakis, J. M. Hammer, G. A. Smith, J. C. Grosskreutz, E. McBride et al Aug. 1974 288 p refs Prepared in cooperation with Black and Veatch Consulting Engr.

(Contract NAS3-18014)

(NASA-CR-134724; Rept-2852-41429) Avail: NTIS HC $8.75 CSCL 10A

The effort undertaken during this program led to the selection of the water-superheated steam (850 psig/900 F) crescent central receiver as the preferred concept from among 11 candidate systems across the technological spectrum of the dynamic conversion of solar generated heat to electricity. The solar power plant designs were investigated in the range of plant capacities from 100 to 1000 Mw(e). The investigations considered the impacts of plant size, collector design, feed-water temperature ratio, heat rejection equipment, ground cover, and location on solar power technical and economic feasibility. For the distributed receiver systems, the optimization studies showed that plant capacities less than 100 Mw(e) may be best. Although the size of central receiver concepts was not parametrically investigated, all indications are that the optimal plant capacity for central receiver systems will be in the range from 50 to 200 Mw(e). Solar thermal power plant site selection criteria and methodology were also established and used to evaluate potentially suitable sites. The result of this effort was to identify a site south of Inyokern, California, as typically suitable for a solar thermal power plant. The criteria used in the selection process included insolation and climatological characteristics, topography, and seismic history as well as water availability. Author

N75-16080*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

OPERATIONAL PERFORMANCE OF A LOW COST, AIR MASS 2 SOLAR SIMULATOR

Kenneth Yass and Henry B. Curtis 1975 10 p refs Proposed for presentation at Inst. of Environ. Sci. Conf., Los Angeles, 13-16 Apr. 1975

(NASA-TM-X-71662; E-8247) Avail: NTIS HC $3.25 CSCL 10A

Modifications and improvements on a low cost air mass 2 solar simulator are discussed. The performance characteristics of total irradiance, uniformity of irradiance, spectral distribution, and beam subtense angle are presented. The simulator consists of an array of tungsten halogen lamps hexagonally spaced in a plane. A corresponding array of plastic Fresnel lenses shapes the output beam such that the simulator irradiates a 1.2 m by 1.2 m area with uniform collimated irradiance. Details are given concerning individual lamp output measurements and placement of the lamps. Originally, only the direct component of solar irradiance was simulated. Since the diffuse component may affect the performance of some collectors, the capability to simulate it is being added. An approach to this diffuse addition is discussed. Author

N75-16081# Committee on Public Works (U. S. Senate).
FUEL AVAILABILITY AND ALLOCATION IN THE UNITED STATES
Washington GPO 1974 176 p Hearing before Subcomm. on Energy of Comm. on Public Works, 93d Congr., 2d Sess., 4 Feb. 1974
(GPO-31-711) Avail: Subcomm. on Energy

Allocation and distribution of gasoline in the U.S. is discussed in terms of possible inequities in the allocation program. It is concluded that the burden of the energy crisis is to be equally shared. J.M.S.

N75-16082# Federal Power Commission, Washington, D.C.
TOTAL ENERGY SUPPLY AND DEMAND, VOLUME 1, CHAPTER 6
[1974] 105 p refs
Avail: NTIS HC $5.25

The future availability of natural gas supply in the U.S. is assessed and compared to the future supplies of other energy sources and to total energy availability as projected to the year 1990. Major factors considered are: (1) the relationship of gas to the energy system and to major components of the system, including other fuels; and (2) the relationship of energy demand and growth to economic growth. The assessment is conducted within a framework of world energy supply and demand due to increased U.S. dependence on foreign sources of energy. Projections are based on the assumption that the declining availability of domestic natural gas will be made up from domestic and foreign supplies of other energy sources, as well as imported gas and liquefied natural gas. Thus, a rate of total energy growth that will meet the essential needs of the economy and sustain an average rate of economic growth of four percent annually is maintained. J.M.S.

N75-16083# Committee on Science and Astronautics (U. S. House).
ENERGY FROM US AND CANADIAN TAR SANDS: TECHNICAL, ENVIRONMENTAL, ECONOMIC, LEGISLATIVE, AND POLICY ASPECTS
Washington GPO Dec. 1974 97 p refs Rept. presented to Subcomm. on Energy of Comm. on Sci. and Astronaut., 93d Congr., 2d Sess., 7 Oct. 1974 Prepared by the Library of Congr., Sci. Policy Res. Div. and the Foreign Affairs Div.
(GPO-43-005) Avail: Subcomm. on Energy

A Congressional hearing was conducted to examine the technical, environmental, economic, legislative, and policy aspects of obtaining petroleum energy from the tar sands of the United States and Canada. Testimony was submitted on the following subjects: (1) the nature, location, and extent of major tar sands, (2) U.S. policy and legislative aspects of U.S. development, (3) the Canadian tar sands industry, and (4) Canadian oil policies and their implications for exports to the U.S. Maps of the known sources of tar sands are included. P.N.F.

N75-16084*# Pratt and Whitney Aircraft, South Windsor, Conn. Engineering Facility.
DEVELOPMENT OF ADVANCED FUEL CELL SYSTEM, PHASE 2 Final Report, 30 Jun. 1972 - 30 Sep. 1973
L. M. Handley, A. P. Meyer, and W. F. Bell 30 Sep. 1973 170 p
(Contract NAS3-15339)
(NASA-CR-134721; PWA-4984) Avail: NTIS HC $6.25 CSCL 10A

A multiple task research and development program was performed to improve the weight, life, and performance characteristics of hydrogen-oxygen alkaline fuel cells for advanced power systems. Development and characterization of a very stable gold alloy catalyst was continued from Phase I of the program. A polymer material for fabrication of cell structural components was identified and its long term compatibility with the fuel cell environment was demonstrated in cell tests. Full scale partial cell stacks, with advanced design closed cycle evaporative coolers, were tested. The characteristics demonstrated in these tests verified the feasibility of developing the engineering model system concept into an advanced lightweight long life powerplant. Author

N75-16085*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Space Systems Div. Electrical Power Systems.
TEST REPORT SEPS SOLAR ARRAY ROOT SECTION MODEL
6 Dec. 1974 50 p
(Contract NAS8-30315)
(NASA-CR-120606; LMSC-D384288) Avail: NTIS HC $3.75 CSCL 10A

The fabrication and test of a solar array functional root section model to verify preliminary array design concepts is presented. The root section model is full scale width and contains a model array blanket. The blanket contains 1/8 live electrical modules and the remainder contains solar cell mass simulators. A storable Astromast is used for array blanket extension and retraction. The model component and system assembly hardware, tests, and test results are described. Author

N75-16086# Organization for Economic Co-Operation and Development, Paris (France).
MODELS FOR PREDICTION OF AIR POLLUTION
J. R. Mahoney 15 Apr. 1971 85 p refs
Avail: NTIS HC $4.75

Modeling techniques are discussed for providing solutions to long-range air pollution planning problems. Current air pollution prediction models which do not allow for transformations and loss of the pollutants are discussed along with considerations for improving these models. F.O.S.

N75-16087# Oslo Lysverker (Norway).
OSLO'S FUTURE POWER SUPPLY
Jan. 1974 95 p In NORWEGIAN
(NP-20121) Avail: AEC Depository Libraries HC $7.75

In a general introduction the potential sources of energy and related environmental aspects are summarized. Hydroelectric, fossil fuelled, and nuclear power, and combined power-district heating are discussed. The energy supply situation in Oslo is described along with energy consumption in Norway. Economic factors such as investments, financing, and prices are discussed. A proposal for a program for the future development of the city's energy supply is presented. A detailed survey of energy sources and power plants, and Oslo Lysverker's price tariff is included. NSA

N75-16088# Handelsministeriet, Copenhagen (Denmark).
COORDINATED EXTENSION OF POWER PLANTS IN THE 1980'S. A STATEMENT SUBMITTED TO THE MINISTRY OF COMMERCE, SHIPPING, AND INDUSTRY BY THE ENERGY COMMITTEE OF THE POWER PLANTS
Mar. 1974 33 p In DANISH
(NP-20023) Avail: NTIS Avail: AEC Depository Libraries HC $4.75

A statement from Denmark on the extension of power plants is presented and concludes that the capital involved will be of the same size for nuclear and conventional power plants. On the background of rising prices for fossil fuel the future energy pattern and energy development including their distribution upon energy raw materials must be set out. Nuclear energy is a suitable means of lessening Denmark's dependence upon oil and coal. The necessary capital should be acquired through self-financing, and foreign loans should be considered if necessary. If the activities of the power plants are tightened for financial reasons, reductions in electricity consumption must be considered in the not too distant future. Author (NSA)

N75-16089# Los Alamos Scientific Lab., N.Mex.
GEOTHERMAL ENERGY: A NEW APPLICATION OF ROCK MECHANICS
J. C. Roegiers and D. W. Brown 1974 15 p refs Presented at the 3rd Intern. Congr. on Rock Mech., Denver, 1 Sep. 1974 Sponsored by AEC
(LA-UR-74-821; Conf-740909-2) Avail: NTIS HC $3.25

The extraction of thermal energy from the numerous regions of the earth's crust containing hot-but essentially dry-rock at moderate depths, may offer a solution to the developing world energy crisis. A deep exploratory hole has already been drilled into basement crystalline rock in north-central New Mexico, and tested at various horizons. These experiments have demonstrated that a large vertical fracture system can be created in granitic rocks using conventional hydraulic fracturing techniques. Of more importance relative to the Los Alamos convective energy extraction concept, an open pressurized fracture system has been maintained in these crystalline rocks for many hours with only negligible fluid leak off. Further, an analysis of seismic signals resulting from the hydraulic fracturing process indicates that a method may be available to determine both the orientation and vertical extent of the resulting fracture. Author (NSA)

N75-16090# California Univ., Livermore. Lawrence Livermore Lab.
AEC IN SITU OIL SHALE PROGRAM
J. S. Kahn 3 Jun. 1974 16 p refs
(Contract W-7405-eng-48)
(UCID-16520) Avail: NTIS HC $3.25

In order to make use of the vast oil shale deposits of the Western U.S., the AEC recommends an accelerated program to develop the technical base essential to the commercialization of a modified in situ technology. A void volume is created by mining a portion of the oil shale deposit and rubblizing the rock above the volume. The rubble zone is then retorted underground. Technical and economic analysis of these field programs would determine the commercial feasibility of the process. If feasibility is determined, the field program would be scaled up to larger volumes. The following technical issues have been identified as critical to commercial feasibility: (1) determination of minimum porosity; (2) determination of rubblization procedures to achieve minimum porosity; (3) determination of process variables affecting maximum retort rates, highest conversion efficiency and optimum product quality; (4) control of process parameters; (5) identification and resolution of mine safety issues; (6) identification of key environmental issues; (7) analysis of the operation of the total retorting system; and (8) the demonstration of the process on a commercial scale and technology transfer. Author (NSA)

N75-16091# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
BENEFICIAL USES OF WASTE HEAT
O. Ilari, A. Antonelli, and G. Boeri Mar. 1974 52 p refs Presented at the Study Group on the Release of Thermal Effluents of Nuclear Power and its Environmental Impact, Vienna, 23-27 Oct. 1972
(RT/PROT-(74)10; Conf-7210122-1) Avail: AEC Depository Libraries HC $5.50

The problem of the utilization of waste heat from electric power stations as an alternative method of the direct disposal to the environment is examined. The problem of thermal pollution is particularly relevant in consideration of the foreseeable increase of nuclear power production in the near future; this concern may find a partial solution by means of suitable technologies (cooling towers or ponds); or by the utilization of waste heat for beneficial uses; in this way waste heat is no longer considered as an environmental factor of pollution, but as energy still usable, even though degraded. In the review of the efforts made in some countries with a more developed nuclear industry, different practical cases of applications or plants, for the utilization of waste heat: sewage processing, domestic heating are discussed. Author (NSA)

N75-16092# Oak Ridge National Lab., Tenn.
NSF-RANN ENERGY ABSTRACTS A Monthly Abstract Journal of Energy Research
M. P. Guthrie, ed. May 1974 46 p
(Contract W-7405-eng-26)
(ORNL-EIS-74-52-Vol-2-5) Avail: NTIS HC $3.75

Bibliographic citations with abstracts are presented for 105 publications concerning energy and energy sources including supply, demand, research, policy, consumption, forecasting, management, and environmental problems. The publications cited are technical journal articles, popular or semi-technical magazine articles, topical reports, symposium papers and proceedings, monographs, and books. NSA

N75-16093# Combustion Power Co., Inc., Menlo Park, Calif.
ENERGY CONVERSION FROM COAL UTILIZING CPU-400 TECHNOLOGY Monthly Progress Report, Jul. - Aug. 1973
Oct. 1973 102 p refs
(Contract DI-14-32-0001-1536)
(PB-235817/4) Avail: NTIS HC $5.25 CSCL 10A

Progress on modification of the CPU-400 (coal combustion unit) pilot plant is discussed. The plant, constructed to convert heat energy of solid waste to electrical energy through use of a gas turbine/generator, is being modified to accept coal as the energy source. Installation of coal processing and feed systems are covered, along with experiments demonstrating the viability of the direct coal-fired gas turbine approach using CPU-400 technology. Author (GRA)

N75-16094# Voorhees (Alan M.) and Associates, Inc., McLean, Va.
GUIDELINES TO REDUCE ENERGY CONSUMPTION THROUGH TRANSPORTATION ACTIONS
May 1974 128 p refs Sponsored by Urban Mass Transportation Admin.
(PB-235983/4; UMTA-IT-06-0092-74-2) Avail: NTIS HC $5.75 CSCL 21D

This document is intended to serve as an aid to local transportation planners, traffic engineers, and administrators in the incorporation of energy conservation considerations into the transportation planning process, especially in reference to short-range transportation planning. Various types of low cost, short-term transportation actions are summarized and their potential for reducing energy consumption is estimated. Summary tables are presented which array the actions in terms of relevant institutional and legal considerations, and socioeconomic and environmental effects. Interrelationships between the energy consumption reduction potential of groups of actions are discussed and a process for formulation of coherent packages of such actions is presented. Guidelines are presentd for evaluating and formulating these action packages for large (1,000,000 and over population), medium (250,000 to 1,000,000), and small (50,000 to 250,000) urban areas. GRA

N75-16095# Maryland Univ., College Park. Dept. of Mechanical Engineering.
PROCEEDINGS OF THE SOLAR HEATING AND COOLING FOR BUILDINGS WORKSHOP. PART 2: PANEL SESSIONS, MARCH 23
Redfield Allen Apr. 1974 67 p Workshop held at Washington, D. C., 21 - 23 Mar. 1973
(Grant NSF GI-32488)
(PB-235483/5; NSF/RA/N-74-014; NSF/RANN/SE/GI-32488/PR/73) Avail: NTIS HC $4.25 CSCL 13A

The meeting was called in recognition of the pressing need for exchange of information among researchers in this rapidly expanding field. Papers were presented under the following subject headings: solar building technology; NSF solar heating and cooling for buildings program; industrial activities; related building activities. GRA

N75-16096# Indiana Univ., Bloomington.
PROCEEDINGS OF THE WORKSHOP ON BIO-SOLAR CONVERSION
Martin Gibbs, Alexander Hollaender, Bessel Kok, Lester O. Krampitz, and Anthony SanPietro 1974 93 p refs Workshop held at Bethesda, Md., 5-6 Sep. 1973
(Grant NSF GI-40253)
(PB-236142/6; NSF/RA/N-74-041) Avail: NTIS HC $4.75 CSCL 10B

Proceedings of a workshop to consider feasibility of using photosynthesis (or a modified form thereof) to generate hydro-

gen as a source of energy are presented. Topic areas covered include: photo-hydrogen metabolism in algae; problems and suggestions dealing with solar energy; reactions of molecular hydrogen in macro-algae; photosynthesis (general); homogeneous hydrogenase from chromatium; genetic reengineering of photosynthetic microorganisms to obtain efficient hydrogen-producing photosystems; solar energy fixation with algal-bacterial systems; economic constraints on solar photosynthetic energy conversion; nature of the desired reduced product in bio-solar energy processes; genetic feasibility of biological energy conversion; and a proposal to search for mutant strains carrying oxygen resistant hydrogenase. GRA

N75-16097*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
WORKSHOP PROCEEDINGS: PHOTOVOLTAIC CONVERSION OF SOLAR ENERGY FOR TERRESTRIAL APPLICATIONS. VOLUME 1: WORKING GROUP AND PANEL REPORTS
Oct. 1973 112 p Conf. held at Cherry Hill, N. J., 23-25 Oct. 1973 2 Vol.
(Contract NAS7-100; Grant NSF AG-485)
(NASA-CR-138209; PB-234860/5; NSF/RA/N-74-013-1) Avail: NTIS HC $5.25 CSCL 10B

The workshop on photovoltaic conversion of solar energy for terrestrial applications was called in recognition of the pressing need for the exchange of information among researchers in this field and to promote a dialogue between researchers and representatives of manufacturing, marketing, government and utilities. The proceedings of this photovoltaic workshop cover working group summaries and discussions and technical presentations. GRA

N75-16098*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
WORKSHOP PROCEEDINGS: PHOTOVOLTAIC CONVERSION OF SOLAR ENERGY FOR TERRESTRIAL APPLICATIONS. VOLUME 2: INVITED PAPERS
Oct. 1973 294 p refs Conf. held at Cherry Hill, N. J., 23-25 Oct. 1973 Sponsored in part by NASA 2 Vol.
(Grant NSF AG-485)
(NASA-CR-138193; PB-234861/3; NSF/RA/N-74-013-2) Avail: NTIS HC $8.75 CSCL 10B

Technical presentations and discussions of a workshop on terrestrial applications of solar energy are presented. Topic areas cover systems and diagnostics, cadmium sulfide/copper sulfide thin film cells, single crystal and polycrystalline silicon, and other materials and devices. GRA

N75-16099# Peat, Marwick, Mitchell and Co., Washington, D.C.
INDUSTRIAL ENERGY STUDIES OF GROUND FREIGHT TRANSPORTATION, VOLUME 1 Final Report
R. H. Leilich, J. C. Prokopy, and D. Ruina Jul. 1974 237 p refs
(Contract DI-14-01-001-1670)
(PB-236016/2; FEA/EI-1670) Avail: NTIS HC $7.50 CSCL 10A

Detailed energy use data for truck and railroad freight transportation in selected SIC categories is developed. Industry characteristics of energy use, sources of supply, and conservation and substitution measures, for railroad, line haul; railroads, switching and terminal establishments; REA express; local trucking, with and without storage, and terminal and joint terminal maintenance facilities for motor freight transportation; and trucking are covered. GRA

N75-16100# Peat, Marwick, Mitchell and Co., Washington, D.C.
INDUSTRIAL ENERGY STUDIES OF GROUND FREIGHT TRANSPORTATION. VOLUME 2: APPENDICES Final Report
R. H. Leilich, J. C. Prokopy, and D. Ruina Jul. 1974 55 p refs
(Contract DI-14-01-001-1670)
(PB-236017/0; FEA/EI-1670-A) Avail: NTIS HC $4.25 CSCL 10A

Energy use characteristics are developed by SIC code for each major kind of fuel and type of process. Emphasis is placed on energy consumption in ground freight transportation, specifically railroads, and for-hire and privately operated motor carriers of freight. The best of earlier research is supplemented by additional research to develop data. Substitutability and conservation alternatives of numerous fuels and their potential energy impacts are identified. Author

N75-16101# General Electric Co., Philadelphia, Pa. Space Div.
SOLAR HEATING AND COOLING OF BUILDINGS. PHASE O: FEASIBILITY AND PLANNING STUDY. VOLUME 1: Final Report
May 1974 28 p Sponsored by NSF
(PB-235431/4; DOC-74SD4219-Vol-1; NSF/RA/N-74-021A) Avail: NTIS HC $3.75 HC also available from NTIS $45.00/set of 5 reports as PB-235430-SET $9.00/set of 3 executive summaries as PB-235420 CSCL 13A

Work performed in the first step (Phase O) of a program to assess the feasibility and merits of the use of solar energy for heating and cooling buildings and providing hot water is summarized. In Phase O the technical, economic, societal, legal, and environmental factors of solar energy use were studied; problems and potential solutions were identified; and proof-of-concept experiments were planned. GRA

N75-16102# General Electric Co., Philadelphia, Pa. Space Div.
SOLAR HEATING AND COOLING OF BUILDINGS. PHASE O: FEASIBILITY AND PLANNING STUDY. VOLUME 2: TECHNICAL REPORT
May 1974 474 p Sponsored by NSF
(PB-235432/2; DOC-74SD4219-Vol-2; NSF/RA/N-74-021B) Avail: NTIS HC $11.50 HC also available from NTIS $45.00/set of 5 reports as PB-235430-SET CSCL 13A

The results of a study to assess the feasibility and practical merits of the use of solar energy to heat and cool buildings and provide hot water are reported. Included are descriptions of program methodology, development of requirements, systems definition, assessment of capture potential, social and environmental study, preliminary cost study, recommendations for proof of concept experiments, and development of plans for utilization. GRA

N75-16103# TRW Systems Group, Redondo Beach, Calif.
SOLAR HEATING AND COOLING OF BUILDINGS, PHASE O. VOLUME 3: APPENDICES
31 May 1974 365 p refs
(Contract NSF C-853)
(PB-235424/9; TRW-21568-003; NSF/RA/N-74-022C) Avail: NTIS HC $10.00 HC also available from NTIS $20.00/set of 3 reports as PB-235421-SET CSCL 13A

For abstract, see N75-16102.

N75-16104# Illinois Univ., Urbana.
ENERGY USE IN THE COMMERCIAL AND INDUSTRIAL SECTORS OF THE US ECONOMY, 1963
Clark W. Bullard, III and Robert A. Herendeen 21 Nov. 1973 266 p refs
(Grant NSF GI-35179X)
(PB-235487/6; UIUC-CAC-DN-73-105; NSF/RA/N-74-057) Avail: NTIS HC $8.50 CSCL 10A

Detailed analyses are presented of energy use in the 368 commercial and industrial sectors of the U.S. economy in 1963, and of intersector dependence in energy terms. Besides direct use, full attention is paid to the flow of non-energy goods and the energy thereby implied. The approach, which is based on energy input-output analysis, is described. GRA

N75-16105# Data Resources, Inc., Lexington, Mass.
A STUDY OF THE DEMAND FOR GASOLINE Final Report
Jul. 1974 157 p refs Sponsored in part by EPA
(Contract EQC-322)
(PB-235254/0) Avail: NTIS HC $6.25 CSCL 21D

Calculations of the response of the demand for gasoline to alternative levels of prices and incomes for the next 2 years are given, including specific evaluations of the direct and indirect effects of increases in the gasoline tax. The calculations are based on an econometric model of the demand for gasoline developed for Environmental Protection Agency and Council on Environmental Quality by Data Resources, Inc. and projections

made using this model in conjunction with the DRI macro econometeric model of the U.S. economy. GRA

N75-16106# Boston Univ., Mass. Dept. of Chemistry.
PHOTOCHEMICAL CONVERSION OF SOLAR ENERGY Quarterly Progress Report, 1 Jan. - 31 Mar. 1974
Norman N. Lichtin 30 Apr. 1974 22 p refs
(Grant NSF GI-38103)
(PB-235503/0; NSF/RANN/SE/GI-38103/PR/74/1) Avail: NTIS HC $3.25 CSCL 07E

Thin layer wholly illuminate photogalvanic cells were constructed using NESA and platinum electrodes. The electrolyte consisted of iron-thionine solution absorbed on a polyelectrolyte membrane. Evaluation of the performance of cells using aqueous-organic mixtures as solvents was pursued. A number of kinetic parameters were evaluated employing solution in solvents composed of various proportions of water and dimethylacetamide. Using the technique of pulsed laser photolysis-kinetic spectrometry, it was found that in aqueous solution semithionine appears to be gendrated in part by reaction of discreet molecules of triplet thionine with Fe(II) and in part by electron transfer within excited complexes of thionine and Fe(II). GRA

N75-16107# TRW Systems Group, Redondo Beach, Calif.
SOLAR HEATING AND COOLING OF BUILDINGS, PHASE O. VOLUME 1: EXECUTIVE SUMMARY
31 May 1974 87 p
(Contract NSF C-853)
(PB-235422/3; TRW-25168.001; NSF/RA/N-74-022A) Avail: NTIS HC $4.75 HC also available from NTIS $20.00/set of 3 reports as PB-235421-SET HC also available from NTIS $9.00/set of 3 executive summaries as PB-235420 CSCL 13A

The results of a study to establish the technical and economic feasibility of using solar energy for heating and cooling buildings are summarized. Included in the report are: study objectives; significant study results; study methodology; capture potential assessment; social, environmental, and economic impact; proof-of-concept experiments; development plans for phases 1 and 2; utilization planning; and conclusions and recommendations. The report concludes that solar energy will reduce projected fossil fuel consumption in the year 2000 by a very small amount if conventional designs with their high costs are used. GRA

N75-16108# General Electric Co., Philadelphia, Pa. Space Div.
SOLAR HEATING AND COOLING OF BUILDINGS. PHASE O. FEASIBILITY AND PLANNING STUDY. VOLUME 3, BOOK 2, APPENDIX C, TASK 3: ASSESSMENT OF CAPTURE POTENTIAL. APPENDIX D, TASK 4: SOCIAL AND ENVIRONMENTAL STUDY Final Report
May 1973 257 p refs
(Contract NSF C-855)
(PB-235434/8; Doc-74SD4219-Vol-3-Bk-2-App-C; NSF/RA/N-74-021D-Vol-3-Bk-2) Avail: NTIS HC $6.50 HC also available from NTIS $45.00/set of 5 reports as PB-235430-SET CSCL 10A

Appendix C, Assessment of Capture Potential, contains data on the number of buildings, new construction, energy demand, fractions of buildings heated and cooled, and three scenarios for building loads and savings. Appendix D, Social and Environmental Study, presents supplemental material to clarify the information in the Technical Report (Volume 2). Included in this section are discussions of demographic and economic, social, and energy scenarios, impact analysis, and problems and solutions to commercial diffusion. Portions of this document are not fully legible. GRA

N75-16109# Stanford Research Inst., Menlo Park, Calif.
POLLUTION-FREE ELECTROCHEMICAL POWER GENERATION FROM LOW GRADE COAL Final Report
D. F. McMillen, R. D. Weaver, and M. Anbar Jan. 1974 88 p refs
(Grant NSF GI-34027)
(PB-236162/4; NSF/RA/N-74-028) Avail: NTIS HC $4.75 CSCL 10B

Results from a study exploring the feasibility of a combined chemical-electrochemical system for generating electrical power under nonpolluting conditions. The process uses coal or coal products to reduce lead oxide to lead in a molten carbonate medium. The lead contained in the molten carbonate is then used in a metal-air electrochemical cell to generate electrical power. It was demonstrated that: (1) the lead-air electrochemical system in molten carbonate is a feasible system for power generation, (2) feasibility of the concept will not be limited by the rate of PbO reduction and (3) the system is capable of producing electrical power from coal at 3.4 mil/kWh on the basis of a fuel cost of $10 per ton (i.e., with an overall efficiency of 42%). GRA

N75-16110# West Virginia Univ., Morgantown. Engineering Experiment Station.
THE DESIGN AND DEVELOPMENT OF AN INTERACTIVE ENERGY MODEL
Patrick A. Bond and Jack Byrd, Jr. 1974 160 p refs
(Grant NSF GI-32724)
(PB-236144/2; NSF/RA/N-74-094) Avail: NTIS HC $6.25 CSCL 10A

Design and development of an interactive energy simulation model are discussed. The interactive simulation model differs from most energy models in that it considers the actions of the various decisionmakers involved in energy planning. The simulation model proposes various contingencies to each of the decisionmakers and asks them to make decisions according to their priorities. After each decisionmaker decides upon his course of action, the simulation model forecasts the future results of these decisions. GRA

N75-16111# International Research and Technology Corp., Washington, D.C.
INDUSTRIAL ENERGY STUDY OF THE INDUSTRIAL CHEMICALS GROUP Final Report
James C. Saxton, Marc P. Kramer, David L. Robertson, Michael A. Fortune, and Nickolaus E. Leggett 30 Aug. 1974 160 p refs
(Contract DI-14-01-0001-1654)
(PB-236322/4; IRT-342-R) Avail: NTIS HC $6.25 CSCL 10A

Results for energy use in each of the six SIC industries within the industrial chemicals group are given. Report covers the alkalies and chlorine industry; industrial gases industry; inorganic pigments industry; industrial inorganic chemicals industry; cyclic crudes, and cyclic intermediates, dyes, and organic pigments industry; and industrial organic chemicals industry. GRA

N75-16112# Brown Univ., Providence, R.I. Dept. of Engineering.
INVESTIGATION OF THIN FILM SOLAR CELLS BASED ON Cu2S AND TERNARY COMPOUNDS Semiannual Progress Report, 1 Jan. - 30 Jun. 1974
J. J. Loferski, J. Shewchun, A. Wold, R. Arnott, and E. E. Crisman Jul. 1974 47 p
(Grant NSF GI-38102x)
(PB-236278/8; NSF/RANN/SE/GI-38102X/PR/74-12; NSF/RA/N-74-092) Avail: NTIS HC $3.75 CSCL 10B

Thin films of the Cu-S system have been made by sulfurizing thin films of copper on n-type single crystal silicon substrates. The goal was to produce pure Cu2S films; however, under the conditions of the experiment, the films always contained additional phases, some unidentified, in addition to the Cu2S. The Cu(x)S/n-Si heterojunctions exhibit a photovoltaic effect. The short circuit current of the best of these solar cells is promising. Work continues on improving the cells. Thin films of the Cu(x)S are being prepared on substrates like silica, pyrex glass, etc. The conductivity and Hall effect of such films have also been measured. Photovoltaic cells have also been made by the chemical substitution of Cu for Cd on single crystals of pure CdS, CdS containing small amounts of Te, and on CdSe. Modifications have been made in the crystal growth procedure for CuInS2 and two crystals have been grown. GRA

N75-16113# Foster Associates, Inc., Washington, D.C.
PROSPECTIVE REGIONAL MARKETS FOR COAL CONVERSION PLANT PRODUCTS PROJECTED TO 1980 AND 1985. VOLUME 1: MARKET ANALYSIS Final Report, Feb. 1973 - Sep. 1974

Nov. 1974 202 p
(Contract DI-14-32-0001-1509)
(PB-236631/8; OCR-102-Vol-1) Avail: NTIS HC $7.25 CSCL 21D

Potential regional markets for liquid hydrocarbons and high- and low-Btu gas converted from coal are discussed. The report covers transportation economics; demand for gas in 1980 and 1985; seasonal variation in gas demand; natural gas storage; projected gas supply and price; government curtailment policies and incremental pricing; gas supply by region; the electric utility market need for low-Btu gas; and analysis of markets for distillate oil, residual oil, low-Btu gas, and new types of electric generation. GRA

N75-16114# Sheldahl Co., Northfield, Minn. Advanced Products Div.
SOLAR POWER ARRAY FOR THE CONCENTRATION OF ENERGY (SPACE) Semiannual Progress Report, 1 Jan. - 30 Jun. 1974
R. A. Stickley 31 Jul. 1974 281 p Prepared in cooperation with Northern States Power Co., Minneapolis, Foster Wheeler Corp., Livingston, N. J., and Minnesota Univ., Minneapolis
(Grant NSF GI-41019)
(PB-236247/3; NSF/RANN/SE/GI-41019/PR/7412; NSF/RA/N-74-090) Avail: NTIS HC $8.75 CSCL 10B

Technical performance and economics of a heliostat field-central receiver solar energy conversion system operating in a hybrid, energy displacement mode with a conventional fossil fueled electrical power generating system are discussed. Metallized thin film reflective materials are analyzed and tested to determine the feasibility of their use as taut membrane heliostat reflectors. Methods are discussed for predicting the theoretical limits of performance of ideal heliostat arrays; a turntable heliostat concept using multiple edge-mounted reflectors; heliostat command and control requirements; selection of metallized thin film candidates and initiation of environmental exposure tests; parametric design and performance predictions for a concentrator subsystem; energy conversion processes used in conventional fossil fueled power generating systems. GRA

N75-16115# Delaware Univ., Newark. Inst. of Energy Conversion.
DIRECT SOLAR ENERGY CONVERSION FOR LARGE SCALE TERRESTRIAL USE Interim Report, 1 Jan. - 30 Jun. 1974
5 Jul. 1974 97 p refs
(Grant NSF GI-34872)
(PB-236193/9; NSF/RA/N-74-083) Avail: NTIS HC $4.75 CSCL 10B

Good process control is reported for all steps in the production of Cu2S/CdS solar cells. This has resulted in highly reproducible cell performance permitting controlled study of the influence of individual parameters such as etching, barriering, etc. Accelerated life testing continues to substantiate previous estimates of useable life at approximately 50C in excess of 15 years. Cell regeneration experiments are giving positive results. Auger spectroscopy and energy scanning X-ray diffraction results show that high cell performance is related to a high Cu'S ratio in the copper sulfide layer and a critical thickness range. GRA

N75-16116# Helio Associates, Inc., Tucson, Ariz.
AIR-STABLE SELECTIVE SURFACES FOR SOLAR ENERGY COLLECTORS Semiannual Progress Report 1 Apr. - 30 Jun. 1974
A. B. Meinel Jul. 1974 138 p refs
(Grant NSF GI-41895)
(PB-236196/2; NSF/RANN/SE/GI-41895/PR/74/12; NSF/RA/N-74-095) Avail: NTIS HC $5.75 CSCL 10B

The primary effort of this program is to evaluate the possibilities for test of selective surface samples for continued exposure to air and its associated water vapor, carbon dioxide and aerosols to temperature cycles from room temperature up to 150C. A secondary portion of the program is to evaluate collector performance with selective surfaces, in particular, the sensitivity analysis of selective surfaces used on the absorber and on the cover windows. GRA

N75-16117# American Cyanamid Co., Stamford, Conn. Chemical Research Div.
RESEARCH ON CADMIUM STANNATE SELECTIVE OPTICAL FILMS FOR SOLAR ENERGY APPLICATIONS Semiannual Progress Report, 1 Jan. - 30 Jun. 1974
G. Haacke Jul. 1974 31 p ref
(Grant NSF GI-39539)
(PB-236208/5; NSF/RANN/SE/GI-39539/PR/74/2; NSF/RA/N-74-053) Avail: NTIS HC $3.75 CSCL 10B

Detailed characterization of sputter coated cadmium stannate films were carried out. Current deposition technology was found to yield coatings which consist of Cd2SnO4 as major phase and smaller concentrations of CdSnO3 and CdO. The presence of CdO appears to impede the electrical conductivity. Infrared reflectance measurements on cadmium stannate films showed for some samples reflectives as high as 90%, these contained impurities. Highest reflectivities were observed in films doped with either tantalum or indium. Indium and tantalum doped films of different thickness have been prepared to determine optimum coating thickness required for application in solar thermal collectors. Development of backwall CsS/Cu2S solar cells on silica/Cs2SnO4 substrates yielded encouraging results. Cadmium stannate resistance can be made small if appropriate electrical contact geometry is used. GRA

N75-16118# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.
SOLAR THERMAL ELECTRIC POWER SYSTEMS Quarterly Progress Report, 1 Apr. - 30 Jun. 1974
Jul. 1974 28 p refs Prepared jointly with Westinghouse Electric Corp.
(Grant NSF GI-37815)
(PB-236368/7; QPR-2; NSF/RANN/SE/GI-37815/PR/74/2; NSF/RA/N-74-082) Avail: NTIS HC $3.75 CSCL 10B

Parametric performance and cost models were developed for many concentrating collector, heat transport, and heat storage subsystems. A dynamic programming method of optimization was used to select optimal solar thermal power systems, and a dynamic simulation computer program was developed to calculate the power station output using hourly solar and weather data. Power systems from 3 to 300 MW capacity that can be used in electrical networks were considered. GRA

N75-16119# Arizona Univ., Tucson. Optical Sciences Center.
CHEMICAL VAPOR DEPOSITION RESEARCH FOR FABRICATION OF SOLAR ENERGY CONVERTORS Semiannual Progress Report, 1 Jan. - 30 Jun. 1974
B. O. Seraphin 15 Aug. 1974 78 p refs
(Grant NSF GI-36731)
(PB-236189/7; SAPR-1; NSF/RANN/SE/GI-36731IX/PR/74/2; NSF/RA/N-74-077) Avail: NTIS HC $4.75 CSCL 10B

This project supports research on a new approach to a selective solar energy convertor that can be used to transform solar radiation into high temperature heat. The selective solar energy convertor is basically a two-layered construction in which the top layer is a semiconductor material, such as silicon, having high absorption for solar radiation and high transparency for blackbody radiation from the heated unit. The bottom layer is a metal film having high reflectance. A chromium oxide layer on top of the stainless steel substrate reduces the effects of a mismatch of thermal expansion and inhibits interaction between substrate and multilayer stack. The successful transfer of the previously developed technology to stainless steel substrates is described. Several hundred temperature cycles of the stack up to 500C did not induce detrimental effects. Changes in the optical characteristic of the stacks at 500C do not lead to a degradation of the optical performance. GRA

N75-16120# Arizona State Univ., Tempe. Engineering Research Center.
TERRESTRIAL PHOTOVOLTAIC POWER SYSTEMS WITH SUNLIGHT CONCENTRATION Semiannual Progress Report, 15 Jan. - 30 Jun. 1974
C. E. Backus Jul. 1974 137 p refs Prepared in cooperation with Spectrolab, Sylmar, Calif.
(Grant NSF GI-41894)
(PB-236180/6; SAPR-1; ERC-R-74010;

NSF/RANN/SE/GI-41894/PR/74/2; NSF/RA/N-74-076) Avail: NTIS HC $6.25 CSCL 10B

Basic parametric relationships inherent in a solar system that concentrates sunlight onto solar cells are investigated. These relationships can then be used to determine the optimum combinations of components that minimize the cost per watt of these systems. Existing analytical models were used to study solar cell response to high intensites and the characteristics of several optical concentrators operating over a time period of a year. Methods were developed to predict the direct incident radiation. Land-space utilization was shown to be related to the number of hours of tracking, and hence the watt-hours of power that can be guaranteed. GRA

N75-16121# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PHOTOVOLTAIC CONVERSION OF SOLAR ENERGY FOR TERRESTRIAL APPLICATIONS. VOLUME 1: WORKING GROUP AND PANEL REPORTS
1974 107 p Conf. held at Cherry Hill, N. J., 23-25 Oct. 1973
(Grant NSF AG-485)
(PB-236163/2; NSF/RA/N-74-013A-Vol-1) Avail: NTIS HC $5.25 CSCL 10B

The Workshop was called in recognition of the pressing need for exchange of information concerning solar energy for terrestrial applications and to promote a dialogue between researchers and representatives of manufacturing, marketing, government, and utilities. The meeting was also intended to aid NSF in planning resources and in developing reasonable goals and milestones for the photovoltaic program with the constraints of expected funding. The introductory remarks by NSF, the working group summaries and discussions, and the panel discussion are included. GRA

N75-16122# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PHOTOVOLTAIC CONVERSION OF SOLAR ENERGY FOR TERRESTRIAL APPLICATIONS. VOLUME 2: INVITED PAPERS
1974 288 p Presented at the Workshop, Cherry Hill, N. J., 23-25 Oct. 1973
(Grant NSF AG-485)
(PB-236164/0; NSF/RA/N-74-013B-Vol-2) Avail: NTIS HC $8.75 CSCL 10B

Technical presentations and discussions of the photovoltaic workshop are covered. Topic areas include single-crystal silicon, polycrystalline silicon, systems and diagnostics, CdS/Cu2S thin film cells, and other materials and devices. GRA

N75-16123# British Steel Corp., Sheffield (England). Information Services.
COAL PETROGRAPHY AND PETROLOGY. A BIBLIOGRAPHY 1964 - 1973
R. L. Davies Aug. 1974 22 p refs
(PB-236351/3; SM/BIB/859) Avail: NTIS HC $3.25 CSCL 08G

A bibliography of 161 briefly annotated references to the published technical journal literature on coal petrology and petrography is presented. GRA

N75-16124# Geological Survey, Denver, Colo.
AVERAGE OIL YEILD TABLES FOR OIL SHALE SEQUENCES IN CORES FROM THE UINTA BASIN, UTAH, THAT AVERAGE 15, 20, 25, 30, 35, AND 40 GALLONS PER TON Final Report
Janet K. Pitman and William B. Cashion 1974 345 p
(PB-236068/3; USGS-GD-74-035) Avail: NTIS HC $9.50 CSCL 08G

The Oil-Shale Data Analysis Program developed by the U.S. Geological Survey was designed primarily for the computation of resource estimates from Fischer assay data. The program was used to generate tables of oil-shale intervals that maintain specified average oil yields for oil-shale cores in the Uinta Basin, Utah. Data are arranged by township, range, and section. GRA

N75-16125# Gilbert Associates, Inc., Reading, Pa.
LOW BtU GASIFICATION HIGH TEMPERATURE-LOW TEMPERATURE H2S REMOVAL COMPARISON EFFECT ON OVERALL THERMAL EFFICIENCY IN A COMBINED CYCLE POWER PLANT Interim Report, Apr. - Sep. 1973
R. A. Ashworth and G. W. Switzer Jan. 1974 65 p refs
(Contract DI-14-32-0001-1236)
(PB-235780/4; OCR-79-INT-1) Avail: NTIS MF $2.25; SOD HC $1.85 CSCL 07A

The effect of high temperature and low temperature coal gas desulfurization on power plant thermal efficiency is compared. A combined power cycle, gas turbine and steam turbine, was assumed for the coal gasification/power generation process. Material balances, flow sheets with temperature, pressure, energy output, and overall heat balance closure are considered. GRA

N75-16126# Ford Motor Co., Dearborn, Mich. Scientific Research Staff.
RESEARCH ON ELECTRODES AND ELECTROLYTE FOR THE FORD SODIUM-SULFUR BATTERY Annual Report, 30 Jun. 1973 - 29 Jun. 1974
Jul. 1974 287 p refs
(Contract NSF C-805)
(PB-235484/3; NSF/RA/N-74-070) Avail: NTIS HC $8.75 CSCL 10C

The report details research findings on (1) the effects of powder preparation on sintering characteristics of alumina ceramics, (2) the variation of strength and resistivity as a function of ceramic composition, (3) the preparation of green ceramic by isostatic pressing and extrusion, (4) the preparation of fired ceramic by hot pressing and rapid sintering in air and (5) the development of a procedure to determine the strength of conductive ceramic tubes. Exploratory laser-Raman studies were undertaken with some polysulfides in the molten state. Analysis of a failed cell indicated the presence of iron in the melt, but no evidence of attack on the ceramic surface. The kinetic studies led to a postulation of a mechanism including identification of limiting reaction(s). Experimental results verified some predictions of the simple porous electrode model and demonstrated the need for a more complex model. Cell materials are discussed. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N75-16127# Committee on Public Works (U. S. Senate).
REPORT FROM THE NATIONAL ACADEMY OF SCIENCES
Washington GPO 1974 46 p refs Rept. presented to Subcomm. on Environ. Pollution of Comm. on Public Works, 93d Congr., 2d Sess., 6 Sep. 1974 Prepared by Natl. Acad. of Sci. - Natl. Res. Council
(GPO-40-500) Avail: Subcomm. on Environ. Pollution

The effect on air quality is discussed for automobile emissions (carbon monoxide, nitrogen oxides, hydrocarbons, and photochemical oxidants) and industrial pollutants (sulfur oxides and sulfates). The health risk to urban populations of these emissions was studied. Present air quality standards are presented and cost-benefit analyses for proposed changes in standards are included. M.J.S.

N75-16128*# National Aeronautics and Space Administration. National Space Technology Labs., Bay Saint Louis, Miss.
WATER HYACINTHS FOR REMOVAL OF PHENOLS FROM POLLUTED WATERS
B. C. Wolverton 5 Feb. 1975 18 p refs
(NASA-TM-X-72722) Avail: NTIS HC $3.25 CSCL 13B

Removal of phenol by water hyacinths (Eichhornia crassipes (Mart.) Solms) in static water was investigated. 2.75 g dry weight of this aquatic plant demonstrated the ability to absorb 100 mg of phenol per plant per 72 hours from distilled water, river water, and bayou water. One hectare of water hyacinth plants is shown to be potentially capable of removing 160 kg of phenol per 72 hours from waters polluted with this chemical. Author

N75-16129*# National Aeronautics and Space Administration. National Space Technology Labs., Bay Saint Louis, Miss.
WATER HYACINTHS FOR REMOVAL OF CADMIUM AND NICKEL FROM POLLUTED WATERS

B. C. Wolverton 5 Feb. 1975 11 p refs
(NASA-TM-X-72721) Avail: NTIS HC $3.25 CSCL 13B

Removal of cadmium and nickel from static water systems utilizing water hyacinths (Eichhornia crassipes (Mart.) Solms) was investigated. This aquatic plant demonstrated the ability to rapidly remove heavy metals from aqueous systems by root absorption and concentration. Water hyacinths demonstrated the ability to absorb and concentrate up to 0.67 mg of cadmium and 0.50 mg of nickel per gram of dry plant material when exposed for a 24-hour period to waters polluted with from 0.578 to 2.00 ppm of these toxic metals. It is found that one hectare of water hyacinths has the potential of removing 300 g of cadmium or nickel from 240,000 liters of water polluted with these metals during a 24-hour period. Author

N75-16130# Committee on Public Works (U. S. Senate).
ENVIRONMENTAL PROTECTION AGENCY'S BUDGET REQUEST FOR FISCAL YEAR 1975
Washington GPO 1974 408 p refs Hearings before Subcomm. on Environ. Pollution of Comm. on Public Works, 93d Congr., 2d Sess., 25-26 Feb. and 1 Mar. 1974
(GPO-30-633) Avail: SOD HC $3.00

The proposed 1975 budget of the Environmental Protection Agency is reviewed. Levels of expenditure requested are compared with the statutory authorization under Federal environmental law. The adequacy of the EPA budget and projected manpower and funding levels for existing programs are evaluated in terms of the demands of the programs and new legislative proposals. J.M.S.

N75-16131*# Naval Biomedical Research Lab., Oakland, Calif.
A SIMPLE METHOD FOR ESTIMATION OF COAGULATION EFFICIENCY IN MIXED AEROSOLS
R. L. Dimmick, Alvin Boyd, and H. Wolochow [1975] 9 p
(NASA Order W-13450)
(NASA-CR-142041) Avail: NTIS HC $3.25 CSCL 13B

Aerosols of KBr and AgNO3 were mixed, exposed to light in a glass tube and collected in the dark. About 15% of the collected material was reduced to silver upon development. Thus, two aerosols of particles that react to form a photo-reducible compound can be used to measure coagulation efficiency. Author

N75-16132# Atomic Energy Commission, Washington, D.C. Div. of Biomedical and Environmental Research.
CHEMIST-METEOROLOGIST WORKSHOP, 1974
1974 61 p refs Workshop held at Ft. Lauderdale, Fla., Jan. 14-18 1974 Prepared in cooperation with EPA, Washington, D. C.
(WASH-1217-74) Avail: NTIS HC $4.25

The four panel discussions held at the workshop are reported. The discussion on technology and environmental impact attempted to pinpoint environmental research activities that must be accelerated as a result of the shifts in energy policy aimed at national self-sufficiency, in particular those associated with the increased use of coal and accelerated nuclear implementation. The panel on precipitation chemistry evaluated areas in which precipitation chemistry couples strongly with human welfare. The panel on long range aerosol formation and transport study focused its attention on the need of an improved aerosol monitoring network. The panel on radioactivity in the atmosphere attempted to categorize various probable atmospheric sources of radioactivity and to evaluate each such source as a hazard, a tracer, or both. Author (NSA)

N75-16133# Brookhaven National Lab., Upton, N.Y.
MEASURED EFFECT OF SHEAR ON PLUME DISPERSION
R. M. Brown and P. Michael 1974 6 p refs Presented at the AMS Symp. on Atmospheric Diffusion and Air Pollution, Santa Barbara, Calif., 9-13 Sep. 1974 Sponsored by AEC
(BNL-18951; Conf-740922-1) Avail: NTIS HC $3.25

Multiple plume traversing was studied by aerial measurements at the Long Island Lighting Company's electric power generating plant. It has three 183-m stacks located 60 m apart and the plumes merge within 1 m downwind. Data analyses indicate that for point source releases from tall stacks, the crosswind standard deviations were found to be greater during stable conditions than during neutral conditions. The larger wind shears associated with increased stability are a dominant factor in plume dispersion at great distances downwind during stable conditions. NSA

N75-16134# Battelle Pacific Northwest Labs., Richland, Wash.
DEPOSITION OF AIRBORNE PARTICULATES ONTO PLANT LEAVES
B. Klepper and D. K. Craig 1974 18 p refs Presented at Meeting of Am. Soc. of Plant Physiologists, Ithaca, New York, 17 Jun. 1974
(Contract AT(45-1)-1830)
(BNWL-SA-4945; Conf-740656-1) Avail: NTIS HC $3.25

In order to assess potential environmental hazards from foliar absorption of airborne pollutants released in stack effluents from industrial plants, it is necessary to measure deposition characteristics onto plant foliage. An exposure chamber is described, which permits highly toxic materials, such as plutonium compound aerosols, to be delivered to plant leaves under reproducible conditions of wind speed and aerosol concentration. An aerosol of a gold colloid labelled with Au-198 and having an AMAD of about 0.8 micrometer was used in experiments with bean leaves and with inert surfaces. Measurements were made of leaf projection area, wind speed, and aerosol concentration and particle size distribution. Leaves oriented toward and away from winds of 0.42 cm/sec showed similar deposition rates for particles within AMAD of about 0.8 micrometer. Deposition velocities for leaves were similar to deposition velocities measured for upward facing inert surfaces, which were an order of magnitude greater than downward facing surfaces. Author (NSA)

N75-16135# Battelle Columbus Labs., Ohio.
BIOENVIRONMENTAL EFFECTS ASSOCIATED WITH NUCLEAR POWER PLANTS: A SELECTED BIBLIOGRAPHY
R. Mayer, J. Jefferis, S. Major, and R. S. Davidson 30 Jun. 1974 402 p refs
(Contract W-7405-eng-92)
(BMI-X-654-Add-1) Avail: NTIS HC $10.50

Abstracts, a keyword index, and an author index are provided for publications concerning bioenvironmental effects of nuclear power plants. NSA

N75-16136# National Environmental Research Center, Las Vegas, Nev.
NRDS NUCLEAR ROCKET EFFLUENT PROGRAM, 1959 - 1970
D. E. Bernhardt, R. B. Evans, R. F. Grossman, F. N. Buch, and M. W. Carter Jun. 1974 154 p refs
(Contract AT(26-1)-539)
(NERC-LV-539-6) Avail: NTIS HC $6.25

The health implications of radioactive effluent released during nuclear rocket engine tests are reviewed. Estimates of potential and actual doses resulting from exposure of the off-site population to aerosol effluent from past tests have been 15 percent or less of the appropriate Federal Radiation Council guides and Atomic Energy Commission standards. Possible modes of interaction of particulate effluent with humans were investigated. The most limiting mode of interaction appears to be deposition of particles on skin. A guide was established which stipulates that the probability of a deleterious interaction should be less than 0.0001. Several tests resulted in potential probabilities of interaction near or above this in off-site unpopulated areas. However, there are no known instances of interaction of the particulate effluent with individuals in the off-site population. Author (NSA)

N75-16137# Dow Chemical Co., Golden, Colo. Rocky Flats Div.
EMISSION MONITORING SYSTEMS FOR PLUTONIUM FACILITIES
K. J. Freiberg and C. G. Haynes 1974 10 p Presented at the 13th Air Cleaning Conf., San Francisco, 12 Aug. 1974 Sponsored by AEC
(Rept-2218; Conf-740807-4) Avail: NTIS HC $3.25

The primary purposes of monitoring gaseous effluent are to insure that environmental discharges conform to specified guidelines and to evaluate the performance of the air cleaning system. A system at a plutonium facility is described whose

important characteristics are: (1) continuous monitoring with central readout of the amounts of radioactive and chemical pollutants; (2) extensive fixed sample collection; and (3) measurement of the total effluent volume. Also described is a technique for in-service contamination surveys of filter plenums. The system meets the requirements set forth in the Minimum Design Requirements for New Plutonium Facilities.
Author (NSA)

N75-16138# California Univ., Livermore. Lawrence Livermore Lab.
HAS MAN, THROUGH INCREASING EMISSIONS OF PARTICULATES, CHANGED THE CLIMATE?
H. W. Ellsaesser 1 Aug. 1974 24 p refs Presented at the Atmospheric-Surface Exchange of Particulates and Gaseous Pollutants, 1974 Symp. Richland, Washington 4-6 Sep. 1974 Sponsored by AEC
(UCRL-75902; Conf-740921-1) Avail: NTIS HC $3.25

Diverse data relating to natural and anthropogenic particulate emissions and trends in atmospheric turbidity are reviewed. It is estimated that man now contributes 13.6% of the 3,500,000,000 tons of primary and secondary particulates presently emitted to the atmosphere annually. Values derived for the anthropogenic effect on the trend in total airborne particulates range from 0.06 to 0.4% increase per year. The much larger rates of increase which have been published as proof of an upward trend are due to local or temporary effects and cannot be representative of a global trend. Urban areas plagued by dirty skies prior to the 1940's show measurable improvement in terms of visibility, dust fall, suspended particulates, or the ratio of sunshine in the central city to that at an outlying station. It is concluded that while an anthropogenic upward trend in airborne particulates existed in the past, it has halted and may even be reversed. Author (NSA)

N75-16139# California Univ., Livermore. Lawrence Livermore Lab.
DIRECT SOLUTION OF THE SPHERICAL-HARMONICS APPROXIMATION TO THE TRANSFER EQUATION FOR A PLANE-PARALLEL, NONHOMOGENEOUS ATMOSPHERE
J. V. Dave 17 Jun. 1974 49 p Sponsored by AEC
(UCRL-51581) Avail: NTIS HC $3.75

The method of obtaining a direct solution of the spherical harmonics approximation to the equation of radiative transfer was investigated. It was shown to be efficient for evaluating diffuse fluxes at various levels of a plane-parallel, nonhomogeneous atmosphere containing arbitrary height distributions of absorbing gases, aerosol particles, and cloud water drops. A detailed derivation of the spherical harmonics equations (starting with the basic transfer equation) and a description of the method for the numerical solution of the resultant system of linear equations are presented. The zenith angle relative to the negative normal-optical-thickness axis was measured and earlier derivations were extended to include isotropic illumination of the atmosphere from below. Author (NSA)

N75-16140# Oak Ridge National Lab., Tenn.
REGIONAL ENVIRONMENTAL SYSTEMS ANALYSIS: AN APPROACH FOR MANAGEMENT
M. M. McCarthy, R. C. Durfee, M. L. Newman, S. L. Yaffee, R. Betson, C. W. Craven, Jr., T. L. Cox, J. Holbrook, D. D. Huff, and R. Strand 1974 6 p refs Presented at the 1st Intern. Congr. of Ecology, The Hague Sponsored by AEC
(Conf-740912-1) Avail: NTIS HC $3.25

Procedures developed for the evaluation of environmental consequences of spatially distributed activities are documented. The strategy was to develop integrated analyses of cultural and natural systems. The research is directed toward a 7,000-square-mile, 16-county urban/rural region in the southeastern quarter of the United States centered on Knoxville, Tennessee. An important aspect of this research is the ability to interrelate and to show the cumulative effects of different changes to the environment. The decision maker can begin to interact with the system and see the results of different management decisions.
Author (NSA)

N75-16141# Oak Ridge National Lab., Tenn.
TIME-DEPENDENT, TWO-DIMENSIONAL MATHEMATICAL MODEL FOR SIMULATING THE HYDRAULIC, THERMAL, AND WATER QUALITY CHARACTERISTICS IN SHALLOW WATER BODIES Ph.D. Thesis - Tennessee Univ.
M. Siman-Tov Aug. 1974 452 p refs
(Contract W-7405-eng-26)
(ORNL-TM-4626) Avail: NTIS HC $11.50

A time-dependent, two-dimensional model was developed to provide a practical analytical tool for simulating the transient behavior of the elevation, velocity, and temperature of water and the mass concentrations of various soluble constituents in vertically mixed shallow water bodies. The model is based on a time-dependent discrete element formulation of the basic conservation equations for total mass, momentum, energy, and mass concentration of soluble constituents. These equations are directly formulated in an integral form over each discrete element and then reduced to a set of initial-value ordinary differential equations with respect to time. The equations are numerically integrated by the multistep explicit solution of the Runge-Kutta-Gill method. A stability analysis is presented for evaluation of the time step to be used to avoid computational instabilities.
Author (NSA)

N75-16142# California Univ., Livermore. Lawrence Livermore Lab.
FURTHER NUMERICAL MODEL STUDIES OF THE WASH-OUT OF HYGROSCOPIC PARTICLES IN THE ATMOSPHERE
G. J. Stensland 2 Jul. 1974 23 p refs
(Contract W-7405-eng-48)
(UCRL-51614) Avail: NTIS HC $3.25

Numerical and analytical methods are used to study rainout and washout of hygroscopic particles in the atmosphere. The variation in concentration of hygroscopic material in rain water was investigated as a function of raindrop size class, changing radius of released particles due to drop evaporation, and time from initiation of rainfall. Author (NSA)

N75-16143# Battelle Pacific Northwest Labs., Richland, Wash.
DIFFUSION-DEPOSITION MEASUREMENTS AND MODELING
C. E. Elderkin, D. C. Powell, and P. W. Nickola 1974 7 p refs Presented at the Symp. on Atmospheric Diffusion and Air Pollution, Santa Barbara, 9 Sep. 1974
(BNWL-SA-5036; Conf-740922-3) Avail: NTIS HC $3.25

An attempt was made to improve Gaussian plume dispersion descriptions by including recent advances in atmospheric turbulence and allowing for the turbulent flux of material to the surface by incorporating the deposition velocity. A diffusion-deposition model was assembled and then compared with data from elevated source particulate tracer experiments conducted over the Hanford diffusion grid in neutral through very stable conditions and the deposition velocity was evaluated for the various conditions of the experiments. NSA

N75-16144# Southwest Research Inst., San Antonio, Tex. Vehicle Emissions Research Lab.
EXHAUST EMISSIONS FROM UNCONTROLLED VEHICLES AND RELATED EQUIPMENT USING INTERNAL COMBUSTION ENGINES. PART 6: GAS TURBINE ELECTRIC UTILITY POWER PLANTS
Charles T. Hare and Karl J. Springer Feb. 1974 41 p refs
(Contract EHS-70-108)
(PB-235751/5; SwRI-AR-940; APTD-1495) Avail: NTIS HC $3.75 CSCL 13B

The report includes summaries of test data and discussion on emissions from a number of gas turbine electric utility engines. It also covers the estimation of emission factors and national air quality impact of these engines. A regional estimate of the distribution of these emissions is made. The data are based on work performed by other agencies and groups. The measurements were made by a variety of techniques and included HC, CO, NOx, and sometimes particulate and SOx. Author (GRA)

N75-16145# Research Triangle Inst., Durham, N.C.
GUIDELINES FOR DEVELOPMENT OF A QUALITY ASSURANCE PROGRAM. VOLUME 2: GAS ANALYSIS FOR CARBON DIOXIDE, EXCESS AIR, AND DRY MOLECULAR WEIGHT

Franklin Smith, Denny E. Wagoner, and A. Carl Nelson, Jr. Feb. 1974 67 p refs
(Contract EPA-68-02-1234; Proj. 1HA327)
(PB-235755/6; EPA-650/4-74-005-B) Avail: NTIS HC $4.25 CSCL 14B

Guidelines for the quality control of gas analysis for carbon dioxide, excess air, and dry molecular weight by the Federal reference method are presented. The overall objectives of a quality assurance program and program components are discussed. Operating procedures to insure the collection of data of high quality are discussed along with instructions for performing quality control checks. Directions for assessing data quality on an intrateam basis and for collecting the information necessary to detect and/or identify trouble are given. Information relative to the test method is presented to identify the important operations, variables and factors, and statistical properties of and procedures for carrying out a quality audit for an independent assessment of data quality. GRA

N75-16146# Miami Univ., Coral Gables, Fla.
BIOLOGICALLY ALLOWABLE THERMAL POLLUTION LIMITS, PART 1 AND PART 2
W. Drost-Hansen and Anita Thorhaug May 1974 84 p refs
(Proj. 18050-DET)
(PB-235715/0; W74-11921; EPA-660/3-74-003) Avail: NTIS SOD HC $1.20 CSCL 06F

Literature and theoretical studies have demonstrated the likely existence of critical thermal transition regions for biological activity. Highly nonlinear thermal effects appear to be manifestations of higher-order phase transitions most likely in the vicinal water of the cellular systems. The effects are likely invariants in time and space. Thus, the corresponding critical temperature regions may represent absolute, upper permissible thermal pollution limits. Laboratory experiments, using some 18,000 individuals, have yielded the most accurate thermal tolerances to date for marine estuarine organisms (including macro-algae and larval stages of important food-chain organisms). Gaussian (or skewed-Gaussian) curves for lethal thermal limits were not observed. Instead an abrupt death point occurred, often within an interval of 0.5 to 1C. The temperature tolerances obtained in the laboratory conformed closely to those observed in the field. Thus upper limits found in the laboratory for Halimeda, Penicillus, and Valonia were found to be the thermal limits in the field. GRA

N75-16147# Environmental Health Lab., Kelly AFB, Tex.
THE EFFECT OF ULTRA LOW VOLUME AERIAL DISPERSAL OF NALED ON AN AQUATIC HABITAT ROBINS AFB, GEORGIA
James M. Livingston and James T. Goodwin Oct. 1974 26 p refs
(AD-787653; EHL(K)-74-25) Avail: NTIS CSCL 06/6

Ultra low volume aerial application of naled (Dibrom 14) at 0.7 and 1.5 oz per acre were made at Robins AFB GA on 31 July 1974. The effects of the spray on non target aquatic organisms were monitored utilizing caged fish, shoreline sampling, drift traps, drop traps, acetylcholinesterase levels in fish brain and other observations. Acetylcholinesterase activity in fish brains was depressed in the treated areas but no significant mortality of fish was noted. No gross effects on the normal fauna was observed. From this test it is concluded that no extensive monitoring activities are required for routine spray missions using conventional rates of naled, but closely spaced, multiple applications may require monitoring. Author (GRA)

N75-16148# Environmental Health Lab., Kelly AFB, Tex.
HAZARDOUS NOISE AND INDUSTRIAL HYGIENE SURVEY, 910 TAC FIGHTER GROUP (AFRES), YOUNGSTOWN MUNICIPAL AIRPORT, VIENNA, OHIO 44473
Lawrence W. Grauvogel Sep. 1974 42 p refs
(AD-787652; EHL(K)-74-24) Avail: NTIS CSCL 06/10

At the request of Headquarters, Central Air Force Reserve Region, Ellington AFB TX, a hazardous noise and industrial hygiene survey was conducted 22-24 May 1974 for the 910 TAC Fighter Group (AFRES), Youngstown MA, Vienna OH 44473. Personnel exposed to potentially hazardous noise and sources and areas of potentially hazardous noise are identified by shop. Ventilation, thermal stress and illumination are discussed for each shop and recommendations made. Comprehensive listings by shop of chemicals used and composition are included to aid the physician in identification of the possible source of occupational illnesses encountered. Author (GRA)

N75-16149# Bechtel Corp., San Francisco, Calif.
STUDY OF SINGLE-RESPONSIBILITY CONCEPTS FOR WATER POLLUTION CONTROL PROJECTS Final Report
Apr. 1974 129 p
(Contract EPA-68-01-0973)
(PB-235056/9; BECHTEL-10293-001) Avail: NTIS HC $5.75 CSCL 13B

Characteristics of various types of construction projects are summarized. Method and time of contractor selection, level of contractor responsibility, degree of project control, potential for schedule compression, firmness of cost estimate, availability of process guarantee, and typical compensation methods are described for each project type. Advantages and disadvantages of each type are discussed. GRA

N75-16150# Ross, Hardies, O'Keefe, Babcock and Parsons, Chicago, Ill.
EPA AUTHORITY AFFECTING LAND USE Final Report
Fred P. Bosselman, Duane A. Feurer, and David L. Callies 12 Mar. 1974 230 p refs
(Contract EPA-68-01-1560)
(PB-235331/6; EPA-230/3-74-012) Avail: NTIS HC $7.50 CSCL 13B

Existing EPA statutory and regulatory authority which involves land use requirements or implications is examined. There is a direct relationship between land use control measures and environmental impacts. Many pollution problems can be prevented by implementing land use controls with proper consideration of environmental impact. Emphasis is placed on issues which confront EPA regulatory efforts. It includes an analysis of land use impact of programs implemented under the Clean Air Act, the Marine Protection Research and Sanctuaries Act, the Noise Control Act, and the Solid Waste Disposal Act. Those authorities are set forth in the context of influence on land use making process. State and local responsibility is discussed. The study concludes with a section on existing methods to coordinate agency programs having significant implication for land use decisions including NEPA, the A-95 clearinghouse process, and the Integrated Grants Administration program. Author

N75-16151# Argonne National Lab., Ill.
REDUCTION OF ATMOSPHERIC POLLUTION BY THE APPLICATION OF FLUIDIZED-BED COMBUSTION Monthly Progress Report
A. A. Jonke Oct. 1974 245 p refs
(Contract DI-14-32-0001-1543)
(PB-235840/6; ANL/ES-CEN-F062; MPR-62) Avail: NTIS HC $7.50 CSCL 07A

An experimental program is being carried out to develop advanced technology in pressurized, fluidized-bed combustion of coal and to investigate the effects of operating variables on combustion efficiency, sulfur retention efficiency, and NOx and trace-element levels in the flue gas. Methods for the regeneration of the sulfated additive are being studied so that the additive can be reused in the combustor. Most of the recent experimental work has been devoted to studying various aspects of the different regeneration schemes. However, concurrently with the regeneration studies, the testing and operation of the combustor have continued. Author (GRA)

N75-16152# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
COMPILATION OF AIR POLLUTANT EMISSION FACTORS, SECOND EDITION, SUPPLEMENT NO. 3
Thomas Lahre and William Vatavuk May 1974 55 p refs
(PB-235736/6; AP-42-Suppl-3) Avail: NTIS HC $4.25 CSCL 13B

The report is a supplement for Compilation of Air Pollutant Emission Factors, AP-42. The scope of this second edition has been broadened to reflect expanding knowledge of emissions. The topics covered are natural gas combustion, liquefied petroleum gas consumption, wood/bark waste combustion in boilers, sewage sludge incineration, lead smelting, secondary lead smelting,

chemical wood pulping, pulpboard, plywood veneer, and layout operations. GRA

N75-16153# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
THE EFFECTS OF POLLUTANTS ON MARINE MICROBIAL PROCESSES: A FIELD STUDY
Ralph Mitchell Sep. 1974 44 p
(Contract N00014-67-A-0298-0026; NR Proj. 306-025)
(AD-787602; TR-6) Avail: NTIS CSCL 13/2

Previous studies under the contract have shown that low concentrations of chemical pollutants adversely affect microbial processes in seawater. In this technical report, results are described of a field study of this phenomenon. Red Sea corals were used as a model. The author shows that low concentration of crude oil, copper and available organic matter, which were insufficient to kill the corals directly, upset the microbiological balance on the coral surface. The pollutants stimulated excessive mucus production by the coral. Bacteria were attracted to the mucus and grew on it. Three factors associated with bacteria growth were responsible for the death of the coral colonies: (1) Oxygen depletion; (2) chemical toxins; and (3) bacterial predators, particularly Beggiotoa. (Modified author abstract) GRA

N75-16154# Midwest Research Inst., Kansas City, Mo.
FEASIBILITY OF EMISSION STANDARDS BASED ON PARTICLE SIZE
L. J. Shannon, P. G. Gorman, and W. Park Mar. 1974 235 p refs
(Contract EPA-68-01-0428)
(PB-236160/8; EPA-600/5-74-007; W74-12219) Avail: NTIS MF $2.25; SOD HC $2.50 CSCL 13B

The technical and economic feasibility of particulate emission standards based on particle size was assessed. Attention was focused on standards to regulate the emission of fine particulates-particulates below two micrometers in size. The program was divided into four major areas of effort: (1) analysis of approaches for regulating fine particle emissions from stationary sources; (2) definition of technological and economic requirements necessary for implementation of emission standards; (3) identification of benefits that would accrue if control procedures for fine particulates can be implemented; (4) assessment of overall feasibility of implementation of fine particle emission standards. GRA

N75-16155# Air Pollution Technical Information Center, Research Triangle Park, N.C.
LEAD AND AIR POLLUTION: A BIBLIOGRAPHY WITH ABSTRACTS
Jan. 1974 437 p refs
(PB-235860/4; EPA-450/1-74-001) Avail: NTIS MF $2.25; SOD HC $4.05 CSCL 13B

Abstracts are presented on emission sources; control and measurement methods; air quality measurements; atmospheric interaction; basic science and technology; effects on human health, plants and livestock, and materials; economic effects; standards and criteria; and legal, administrative, and social aspects. GRA

N75-16156# United States-Union of Soviet Socialist Republics Working Group on Stationary Source Air Pollution Control Technology.
PROCEEDINGS OF A SYMPOSIUM ON CONTROL OF FINE-PARTICULATE EMISSIONS FROM INDUSTRIAL SOURCES
1974 716 p refs Symp. held at San Francisco, 15-18 Jan. 1974 Sponsored by EPA
(PB-235829/9; W74-12208; EPA-600/2-74-008) Avail: NTIS HC $17.25 CSCL 13B

Proceedings of the symposium contain papers from U.S. and U.S.S.R. on the application of conventional technologies for control of fine particles (3 microns and less), new concepts for fine particulate control, advances in measurement techniques, and chemical composition of fine particulates. The theory behind and the application of electrostatic precipitators, wet scrubbers, and fabric filters for removal of fine particulates from stationary sources are covered. New concepts covered include sonic agglomeration, electrically induced agglomeration, coagulation and condensation with utilization of electrophoresis, thermophoresis, and diffissiophoresis. The presently applied particulate mass measurement methods, plume opacity measurement, instruments measuring efficiency of particulate control equipment, sampling from high-temperature, reactive, and corrosive gases, measurement of particle size distribution at emission sources are covered in papers on measurement techniques. GRA

N75-16157# Columbia Univ., New York.
THE AUTOMOBILE AND THE REGULATION OF ITS IMPACT ON THE ENVIRONMENT
Frank P. Grad, Albert J. Rosenthal, Laurie R. Rockett, James A. Fay, and John Heywood Jun. 1974 887 p refs
(Grant NSF GI-29965)
(PB-237232/4; NSF/RA/X-74-023) Avail: NTIS HC $19.25 CSCL 13B

An analysis of automotive air pollution problems is presented along with discussion of other environmental consequences of the automobile, including automotive noise, water pollution from used crankcase oil, and junk car disposal. Report covers automobile emission standards and air pollution damages, pollution control strategies, impact of emission controls, current emission control technology, calculations of aggregate emission levels, relationship between automobile noise control and emissions control, crankcase oil disposal methods and regulations, and recycling of junked or abandoned automobiles. GRA

N75-16158# Research Triangle Inst., Durham, N.C.
INVESTIGATION OF OZONE AND OZONE PRECURSOR CONCENTRATIONS AT NONURBAN LOCATIONS IN THE EASTERN UNITED STATES Final Report
E. L. Martinez and Elbert C. Tabor May 1974 236 p refs
(Contracts EPA-68-02-1077; EPA-68-02-1343)
(PB-236931/2; EPA-450/3-74-034) Avail: NTIS HC $7.50 CSCL 13B

The monitoring of ozone and ozone precursors in nonurban areas is reported. The first section presents results of an air quality measurement program for ozone, nitrogen dioxide, and nonmethane hydrocarbons. Monitoring station design, equipment, calibration, and operation are discussed. A quality assurance program describes the procedures employed and the results obtained in an evaluation of the interrelatability of ozone and ozone precursor measurements. Finally an airborne ozone concentration measurement is described. An instrumented C-45 aircraft was employed in an effort to relate surface and lower tropospheric air quality. (Modified author abstract) GRA

N75-16159# Texas A&M Univ., Galveston. Center for Marine Resources.
A QUANTITATIVE STUDY OF OILS AND TARS STRANDED ON GALVESTON ISLAND BEACHES Final Report
Sammy M. Ray, Robert K. Oja, Lela M. Jeffrey, and Bobby J. Presley Jan. 1974 87 p refs
(Contract DOT-CG-23681)
(AD-787718; USCG-D-10-75) Avail: NTIS CSCL 13/2

Strandings of oil and tar on Galveston Island beaches were assessed for 1 year. Most materials collected were tars or tar-like residues that appeared to be highly weathered. There did not appear to be a consistent relationship between oil accumulation and wind speed and direction. Efforts to correlate oil deposition with shipping traffic were unsuccessful. Representative oil tar samples were analyzed periodically by (a) gas chromatography for hydrocarbons, (b) atomic absorption spectrophotometry for nickel, vanadium, chromium and cobalt, (c) carbon 12/13 ratios, and (d) X-ray diffraction analysis for minerals. Most of the samples analyzed appear to be the result of man's activities. (Modified author abstract) GRA

N75-16160# Automotive Environmental Systems, Inc., Westminster, Calif.
UNCONTROLLED VEHICLE EMISSION STUDY Final Report, Feb. 1972 - Nov. 1973
30 Oct. 1973 214 p refs Sponsored by the California Air Resources Board
(PB-235768/9; ARB-R-620-73-19-1) Avail: NTIS HC $7.25 CSCL 13B

A comprehensive study of uncontrolled sources of emissions in California was performed. The objectives of this study were to determine an inventory of emissions from internal combustion

engines not presently controlled by emissions standards and the contribution of those uncontrolled sources to California's air pollution problems. Innovative emissions testing programs were designed and performed for pre-1955 automobiles, motorcycles, lawn and garden equipment, and other small engines. A deterministic prediction model was developed to summarize emissions by type and source on the state, air basin, and county levels, and to project emissions contributions in the same format for future years. (Modified author abstract) GRA

N75-16161# Automotive Environmental Systems, Inc., Westminster, Calif.
UNCONTROLLED VEHICLE EMISSION STUDY, APPENDIX Final Report, Feb. 1972 - Nov. 1973
30 Oct. 1973 120 p Sponsored by California Air Resources Board
(PB-235769/7; ARB-R-620-73-10-2) Avail: NTIS HC $5.25 CSCL 13B

The appendix presents the uncontrolled sources emissions data in several different formats. These are: Statewide daily emissions in base year for all emission types by uncontrolled source category; statewide daily emissions by emission type by uncontrolled source category for 1970, 1972, 1974, 1976, and 1978; base data and statewide daily emissions by emission type by source category, 1970, 1972, 1975, and 1980; air basin-by-air basin daily emissions in base year for all emission types by uncontrolled source category; county-by-county daily emissions in base year for all emission types by uncontrolled source category; uncontrolled source emissions analysis computer program. GRA

N75-16162# Environmental Protection Agency, Athens, Ga. Southeast Environmental Research Lab.
COMPARISON OF GERMANIUM DETECTORS FOR NEUTRON ACTIVATION ANALYSIS FOR MERCURY Environmental Protection Technology Series
Robert V. Moore and Oliver W. Propheter Jun. 1974 17 p refs
(PB-235944/6; W74-12220; EPA-660/2-74-045) Avail: NTIS MF $2.25, SOD HC $0.55 CSCL 13B

Two types of lithium-drifted, solid-state, germanium detectors were compared for their ability to detect and measure mercury in matrices of different complexity. A large, coaxial detector with relatively high efficiency and a good peak-to-Compton ratio, was compared with a thin wafer detector, called a low energy photon detector (LEPD), which has a good resolution for low energy photons. In samples with relatively few elements primarily of low atomic number, the large detector is preferred because of its greater counting efficiency. In complex samples containing many elements that interfere with the mercury peak, e.g., samarium, thorium, barium, and tungsten, the detector of choice is the LEPD because of its ability to resolve the gamma photons. GRA

N75-16163# National Environmental Research Center, Grosse Ile, Mich. Grosse Ile Lab.
THE EPA IFYGL PROJECTS Annual Report
Dec. 1973 351 p refs
(PB-235947/9; EPA-660/3-73-021; W74-12214; AR-1) Avail: NTIS HC $10.00 CSCL 13B

The field data collection phase of an intensive multidisciplinary study of Lake Ontario was conducted in 1972-73 by agencies of the United States and Canada. The scientific program was designed to further the basic scientific knowledge of the Great Lakes, to provide the basis for improved water quality and quantity management, and to comprehend the broad impact of the lake on the environment of the Great Lakes Basin. The Chemistry-Biology Program had three major objectives-material balance studies, evaluation of the current ecologic status of the lake, and the development of predictive mathematical models. GRA

N75-16164# Pacific Northwest Environmental Research Lab., Corvallis, Ore.
WORKBOOK OF THERMAL PLUME PREDICTION. VOLUME 2: SURFACE DISCHARGE
Mostafa A. Shirazi and Lorin R. Davis May 1974 441 p refs Sponsored by EPA
(PB-235841/4; EPA-R2-72-005B) Avail: NTIS MF $2.25; SOD HC $4.15 as EP1.23/2-72-005b CSCL 13B

Nomograms are presented that describe the behavior of surface jets for a wide range of ambient and initial discharge conditions encountered in practice. The nomograms provide qualitative results describing the surface plume trajectory, width, temperature, depth, surface area and time of travel along the plume centerline. The nomograms are not intended to be used as exclusive design tools for surface discharge problems nor for use in a precise prediction of any specific surface plume condition. The nomograms are generated predominantly from an idealized mathematical model of a plume. GRA

N75-16165# Geological Survey, Reston, Va. Water Resources Div.
THE PROCESSING AND STORAGE OF WATER QUALITY DATA IN THE NATIONAL WATER DATA STORAGE AND RETRIEVAL SYSTEM Interim Report
Melvin D. Edwards Sep. 1974 93 p
(PB-236246/5; USGS-WRD-74-034) Avail: NTIS HC $4.75 CSCL 13B

Complete documentation is presented for a digital computer program used for the processing and storage of water quality data in the National Water Data Storage and Retrieval System of the United States Geological Survey. The operation and functional capabilities of the program are presented. The overall data processing system and the modes of data entry and storage are discussed. Interface capabilities with the Water Quality Control Information System (STORET) of the Environmental Protection Agency are also discussed. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N75-16166# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
UNITED STATES EARTHQUAKES, 1971
Jerry L. Coffman, ed. and Carl A. VonHake, ed. 1973 182 p refs
Avail: NTIS MF $2.25; SOD HC $2.10

Epicenters are listed of all earthquakes and associated phenomena recorded in the United States and nearby territories during the year. Brief descriptions of earthquakes are included that were felt or caused damage in the United States, and all available data on tremors noted by residents of the Panama Canal Zone, Puerto Rico, and the Virgin Islands is summarized. In addition, a list of principal earthquakes of the world during the year is presented with brief accounts of their effects. Sources of noninstrumental information include reports received from questionnaire canvasses, newspaper clippings, bulletins of the Seismological Society of America, special reports of other organizations, and data from the National Weather Service of NOAA whose observers prepare periodic reports on local seismic activity. Instrumental data utilized in computing earthquake locations, depths, magnitude, and times of occurrence are obtained from NOAA and cooperating seismological observatories, both domestic and foreign. Author

N75-16167*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NITRIC OXIDE, WATER VAPOR, AND OZONE IN THE ATMOSPHERE AS MEASURED IN SITU FROM AN AIRCRAFT
Daniel Briehl, Brian A. Ridley, Ernest Hilsenrath, and Harold I. Schiff Washington Jan. 1975 12 p refs
(NASA-TM-X-3174; E-8077) Avail: NTIS HC $3.25 CSCL 04A

As part of the instrument evaluation plan for the NASA Global Atmospheric Sampling Program, prototype instruments were tested aboard the NASA Convair 990 during four flights in January and February of 1974. All the data were taken in maritime air between Hawaii and San Francisco and between Hawaii and 155 deg W, 35 deg N. A chemiluminescent instrument was used to measure nitric oxide. Water vapor, which was

measured by using an aluminum oxide hygrometer, ranged from 5.2 micro g/g to saturation. Ozone was measured by an instrument using the ultraviolet absorption technique and ranged up to 235 ppbv. Typical temporal plots of the concentrations of the three constituents are presented. All the constituents showed considerable spatial and day-to-day variation in concentration at each altitude flown. Measurements of the three constituents were made simultaneously at various altitudes between 7.6 and 12.5 km. Author

N75-16168*# Grambling State Univ., La. Dept. of Physics.
THE DOMINANT MODE OF STANDING ALFVEN WAVES AT SYNCHRONOUS ORBIT
W. D. Cummings, Calvin Countee, Donald Lyons, and William Wiley, III 18 Jan. 1975 16 p refs
(Grant NGR-19-011-007)
(NASA-CR-142030) Avail: NTIS HC $3.25 CSCL 08N

Low-frequency oscillations of the earth's magnetic field recorded by the UCLA magnetometer on board ATS-1, have been examined for the six-month interval, January-June, 1968. The initial interpretation, that these oscillations represent the second harmonic of a standing Alfven wave, has been re-examined, and it is concluded that this hypothesis must be withdrawn. Using evidence from OGO-5 and ATS-5, as well as the data from ATS-1, it is argued that the dominant mode at the synchronous orbit must be the fundamental rather than the second harmonic. From 14 instances when the oscillations of distinctly different periods occurred during the same time interval at ATS-1 it is concluded that higher harmonics can exist. The period ratio in 7 of the 14 cases corresponds to the simultaneous occurrence of the second harmonic with the fundamental, and 4 other cases could be identified as the simultaneous occurrence of the fourth harmonic with the fundamental. Author

N75-16169*# General Electric Co., Philadelphia, Pa. Space Div.
NEAR-EARTH THERMAL ENVIRONMENTAL CRITERIA STUDY Final Report
J. M. Dash, T. F. Green, and T. P. Starr 22 Nov. 1974 41 p
(Contract NAS8-29941)
(NASA-CR-120592) Avail: NTIS HC $3.75 CSCL 20M

A study was made to determine improved values and definitions to be used for thermal environmental design parameters for a spacecraft in near-earth orbit. An algorithm was used to derive a total earth thermal radiation based on a mathematical relationship. Several albedo and earth thermal radiation grid maps were produced on seven track digital magnetic tape. Each map contained the values obtained during a 24 hour period over the entire earth. The output statistics are summarized, and the data processing program is described. N.E.R.

N75-16170# Weapons Research Establishment, Salisbury (Australia). Dept. of Supply.
IONOSPHERIC TILTS AND TIDs NEAR THE MAGNETIC EQUATOR
R. F. Treharne Oct. 1973 13 p refs
(WRE-TM-A-239(AP)) Avail: AEC Depository Libraries HC $4.00

A few observations made near the magnetic dip equator show daytime tilts in the F region of the ionosphere to the east and which reverse direction at sunset. During the evening, if spread F is absent, large steady tilts which peak at 2100 hours local time are seen, north in winter, east and west in summer. In addition the effects of (Traveling Ionospheric Disturbances) may be seen to be superimposed on the post sunset peak. The direction, speed, wavelength, and amplitudes of these TID's have been estimated by a single station method. Author (NSA)

N75-16171# Weapons Research Establishment, Salisbury (Australia).
COMPUTER SIMULATION OF TIME-VARYING ANGLE OF ARRIVAL AND DOPPLER SHIFT ASSOCIATED WITH TIDs
P. L. George and J. Miller Nov. 1973 15 p refs
(WRE-TM-A-242(AP)) Avail: AEC Depository Libraries HC $4.00

The results of a computer simulation of hf skywaves in a perturbed ionosphere are presented. Variations in Doppler shift and angle of arrival are compared at both normal and oblique incidence. Attention is drawn to the appearance of multiple ray paths and to the dependence of the oblique path effects upon the direction of travel of the traveling ionospheric disturbances with respect to the propagation path. Author (NSA)

N75-16172# California Univ., Livermore. Lawrence Livermore Lab.
EFFECT OF NO(SUB x) EFFLUENTS ON OZONE
J. S. Chang and H. S. Johnston Jun. 1974 28 p refs Presented at 3d Conf. on CIAP, Boston, 26 Feb. 1974
(UCRL-75801; Conf-740232-1) Avail: NTIS HC $3.75

Model calculations on the reduction of stratospheric ozone by nitrogen oxides from supersonic transport exhausts were carried out from 1971 - 1974. The results of these model calculations are assembled. The spread in calculated reductions of ozone for a given rate of input of nitrogen oxides is about a factor of ten. Some of this spread in results can be identified in terms of differences in the chemistry of the models. However, the greatest source of discrepancy appears to be from different models of eddy diffusion and boundary conditions. Eight models show a surprisingly close agreement when expressed in terms of percentage ozone reduction as a function of percentage increase in the NO sub x column; doubling stratospheric NO sub x is calculated to reduce ozone by 20 percent. Author (NSA)

N75-16173# Brookhaven National Lab., Upton, N.Y.
SPECTRA OF ATMOSPHERIC TURBULENCE OVER THE SEA DURING STABLY STRATIFIED CONDITIONS
S. SethuRaman, R. M. Brown, and J. Tichler 1974 6 p refs Presented at the Symp. on Atmospheric Diffusion and Air Pollution, Santa Barbara, Calif., 9 Sep. 1974 Sponsored by AEC
(BNL-18952; Conf-740922-9) Avail: NTIS HC $3.25

Over water turbulence intensities are found to be 50 to 100 per cent less than those over land for the same stability conditions. Longitudinal and vertical wind speed spectra show the existance of Kolmogoroff's universal form at high wave numbers. Comparison of over-water to over-land spectra indicates a frequency shift towards lower values for the vertical component of wind speed and an amplitude shift towards higher values for the longitudinal component. The ratio sigma sub w/u was found to have an average value of 1.16 for moderately stable flow conditions. The Lagrangian statistical parameters could be predicted from Eulerian turbulence measurements with reasonable success. Author (NSA)

N75-16174# Colorado Univ., Boulder.
STIMULATED DIFFUSION SCATTERING IN IONOSPHERIC MODIFICATION
R. L. Berger, M. V. Goldman, and D. F. DuBois (LASL) Jan. 1974 33 p refs
(Contracts AT(11-1)-2081; F44620-73-C-0003; F30602-72-C-0343; OT-0067)
(COO-2081-18) Avail: NTIS HC $3.75

A linear stability theory is presented for stimulated backscattering of O-mode radiation from diffusion modes. The uncoupled diffusion mode is an electrostatic spatially periodic disturbance which relaxes at the parallel or cross-magnetic field diffusion rate. For ionospheric modification experiment parameters, the most unstable diffusion mode is within one degree of orthogonal to the geomagnetic field, and is characterized by the parallel diffusion rate. It is found to have a maximum temporal growth rate of 20 sec/1 and a wavelength of 100 meters or more at altitudes several tens of kilometers below the O-wave reflection point. The total spatial amplification is calculated for special geometries. Author (NSA)

N75-16175# California Univ., Livermore. Lawrence Livermore Lab.
SENSITIVITY OF TIME-VARYING PARAMETERS IN STRATOSPHERIC MODELING
D. J. Wuebbles and J. S. Chang Jul. 1974 9 p refs Presented at 2nd Intern. Conf. on the Environ. Impact of Aerospace Operations in High Atmosphere, San Diego, Calif., 8 Jul. 1974 Sponsored by AEC
(UCRL-75602; Conf-740723-1) Avail: NTIS HC $3.25

Using a one-dimensional model the sensitivity to the time dependent variations of time-varying parameters was studied along with its effect on the model predicted perturbations. This sensitivity

seems to limit the interpretability of steady state models.
Author (NSA)

N75-16176# Defense Mapping Agency Aerospace Center, St. Louis, Mo.
AN ANALYSIS OF GRAVITY PREDICTION METHODS FOR CONTINENTAL AREAS
Luman E. Wilcox Aug. 1974 308 p refs
(AD-787472; DMAAC-Ref-Pub-74-001) Avail: NTIS CSCL 08/5

Mean gravity anomaly values which represent 1 degree x 1 degree surface areas can be predicted on the continents by geophysical gravity correlation methods whether or not measured gravity data exist within those 1 degree x 1 degree areas. These methods take into consideration the earth's structure, composition, and response to changes in surficial mass distribution by means of observed or computed correlations between gravity and other geophysical parameters within geologic/tectonic provinces. Linear basic prediction functions, used to describe and predict the relationships between gravity and elevation, are shown to be a natural consequence of the properties of gravity reduction procedures and the observed behavior of gravity anomalies within structurally homogeneous regions. (Modified author abstract) GRA

N75-16177# Wisconsin Univ., Madison. Mathematics Research Center.
PLANETARY WAVES OVER THE ROTATING EARTH
M. C. Shen Aug. 1974 36 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-787733; MRC-TSR-1448) Avail: NTIS CSCL 04/2

An asymptotic method is developed for the study of planetary waves in the atmosphere or ocean of variable depth over the rotating earth. An asymptotic solution involving a phase function and an amplitude function is constructed. The phase function satisfies the Hamilton-Jacobi equation and the amplitude function is determined by a conservation relation along each of a family of rays over a unit sphere. Application of the method to wave resonance in a liquid layer on a rotating spherical earth is considered. Author (GRA)

N75-16178# University Coll., London (England). Mullard Space Science Lab.
ION MASS SPECTROMETRY OF THE LOWER IONOSPHERE Final Scientific Report, 1 May 1967 - 31 Dec. 1971
R. L. F. Boyd, E. B. Dorling, K. Norman, and L. J. C. Woolliscroft 15 Feb. 1974 91 p refs
(Contract F6105-67-C-0078; AF Proj. 6687)
(AD-787785; MSSL-205; AFCRL-TR-74-0503) Avail: NTIS CSCL 07/4

A short pathlength radio frequency ion mass spectrometer was developed for rocket measurements in the D- and lower-E regions of the ionosphere without the interposition of a shock between plasma and spectrometer. Design and operation are discussed. Ions of mass 16 + or - 1, 18 + or - 1, 21 + or - 2, 28 + or - 2, 36 + or - 3 and 55 + or - 5 were detected on the ascent and descent between 90(+) and 120 km. The tentative ion identifications are O(+), H3O(+), Na(+), or Mg(+), NO(+), K(+) and Fe(+). (Modified author abstract) GRA

N75-16179# Harry Diamond Labs., Washington, D.C.
NEPHELOMETER FOR MAPPING OF BACKSCATTER AND ATTENUATION COEFFICIENTS
Dominick A. Giglio, Bernard J. Rod, and Howard M. Smalley Feb. 1974 41 p refs
(DA Proj. 1W3-62301-A-301)
(AD-787393; HDL-TR-1660) Avail: NTIS CSCL 04/1

The performance of a backscatter nephelometer in the mapping of aerosol attenuation and backscatter coefficients is evaluated. This instrument, coupled with an automated data processing technique described, performs quite satisfactorily and provides an excellent means of cloud data gathering and optical fuze test support. In addition, some parameter profiles of fair weather cumulus clouds observed in flight tests are presented.
GRA

N75-16180# Teledyne Geotechnical, Garland, Tex.
STUDIES OF LONG-PERIOD SEISMIC NOISE GENERATED BY ATMOSPHERIC PRESSURE CHANGES Interim Technical Report, 1 Apr. 1973 - 31 Mar. 1974.
G. G. Sorrells and E. J. Douze 1 Aug. 1974 42 p
(Contract F44620-73-C-0052; ARPA Order 1827-19; AF Proj. 62701E)
(AD-787874; TR-74-15; AFOSR-74-1663TR) Avail: NTIS CSCL 08/11

Potential contribution of atmospheric pressure sources other than the wind to the seismic noise spectrum in the 20-100 second period range was studied. Results indicate that during calm intervals in the winter months, pressure related earth motion makes a substantial contribution to the observed earth noise spectrum. This contribution becomes detectable at periods on the order of 25 seconds and becomes the principal source of ambient earth motion at periods greater than 50-60 seconds. The evidence to date strongly suggests that the pressure related earth motion is derived principally from naturally occurring atmospheric infrasonic waves. (Modified author abstract) GRA

N75-16181# California Univ., Berkeley. Earthquake Engineering Research Center.
LUSH: A COMPUTER PROGRAM FOR COMPLEX RESPONSE ANALYSIS OF SOIL-STRUCTURE SYSTEMS
John Lysmer, Takekazu Udaka, H. Bolton Seed, and Richard Hwang Apr. 1974 89 p refs
(Grant NSF GK-27760)
(PB-236796/9; EERC-74-4) Avail: NTIS HC $4.75 CSCL 13M

The program LUSH finds the complete response of a plane finite element model representing a soil-structure system. The program differs from more conventional finite element programs in that it, in an approximate manner, takes into account the strong nonlinear effects which occur in soil masses subjected to strong earthquake motions. This is achieved by a combination of an equivalent linear method and the complex response method. The input motion is assumed to be specified as acceleration time histories at a rigid boundary of the finite element model, usually the base, and different time histories may be specified for the horizontal and vertical components of the input motion.
GRA

N75-16182# Defense Mapping Agency Aerospace Center, St. Louis, Mo.
AN EMPIRICAL METHOD FOR THE DETERMINATION OF GRAVITY TERRAIN CORRECTIONS
James T. Voss Jul. 1974 74 p refs
(AD-787474; DMAAC-Ref-Pub-74-003) Avail: NTIS CSCL 08/5

Terrain corrections are usually estimated by laborious determinations of the topographic relations around the gravity station out to distances of 22 to 160 kms on a zone and compartment basis. A systematic measuring of the maximum topographic slope and the mean relative relief out to different distances around gravity stations for which the terrain correction was known showed that a set of empirically derived curves could be established relating the terrain correction to the topographic slope and relative relief within approximately 15 kms of the station. Mathematical definition of this set of curves is accomplished through the use of a simplified solid geometrical model (a cone) to define the terrain effect around the gravity station. The equation for this model is used to determine terrain correction values for a sample of 254 gravity stations in the Sierra Nevada Mountain area. (Modified author abstract) GRA

N75-16459* Kanner (Leo) Associates, Redwood City, Calif.
ATMOSPHERIC EFFECTS AND SIDEREAL-DIURNAL VARIATIONS IN EXTENDED AIR SHOWERS
N. N. Efimov, D. D. Krasilnikov, S. N. Nikolskiy, and F. K. Shamsutdinova *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 133-137 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 87-90 (For availability see N75-16452 07-93) CSCL 04A

N75-16461* Kanner (Leo) Associates, Redwood City, Calif.
ALTITUDINAL, DIURNAL AND LATITUDINAL DEPENDENCES FOR IONIC CONCENTRATIONS FORMED BY CORPUSCULAR FLUXES IN THE STRATOSPHERE AND MESOSPHERE

Yu. A. Bragin *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 142-144 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 93-94 (For availability see N75-16452 07-93)
CSCL 04A

N75-16462* Kanner (Leo) Associates, Redwood City, Calif.
THE EFFECT OF COSMIC RAYS ON THUNDERSTORM ELECTRICITY
Yu. A. Bragin *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 145-147 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 95 (For availability see N75-16452 07-93)
CSCL 04A

N75-16463* Kanner (Leo) Associates, Redwood City, Calif.
POSSIBILITY OF CONTROLLING THE EARTH'S NEGATIVE CHARGE AND THE UNITARY VARIATION OF ITS ELECTRIC FIELD BY COSMIC RAYS
Yu. A. Bragin, S. S. Vorontsov, and A. A. Kocheyev *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 148-153 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 96-97 (For availability see N75-16452 07-93)
CSCL 08N

N75-16464* Kanner (Leo) Associates, Redwood City, Calif.
EFFECT OF THRESHOLD RIGIDITY VARIATIONS ON THE ELECTRON PRODUCTION RATE IN THE ATMOSPHERE
L. I. Dorman, T. M. Krupitskaya, and M. I. Tyasto *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 154-158 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 99-101 (For availability see N75-16452 07-93)
CSCL 04A

N75-16465* Kanner (Leo) Associates, Redwood City, Calif.
SECULAR VARIATIONS OF L, B-COORDINATES
I. V. Getselev, E. V. Gorchakov, and V. A. Eltekov *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 159-163 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 102-104 (For availability see N75-16452 07-93)
CSCL 04A

N75-16466* Kanner (Leo) Associates, Redwood City, Calif.
POSSIBLE ISOTOPIC SHIFTS WITH CHANGES IN THE GEOMAGNETIC FIELD
Yu. P. Bulashevich, V. M. Yershov, and V. F. Zakharchenko *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 164-169 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 105-107 (For availability see N75-16452 07-93)
CSCL 04A

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N75-16183*# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
RADIATION MEASUREMENTS FROM POLAR AND GEOSYNCHRONOUS SATELLITES Annual Report, 1 Oct. 1973 - 30 Sep. 1974
Thomas H. VonderHaar Dec. 1974 38 p refs
(Grant NGR-06-002-102)
(NASA-CR-142022) Avail: NTIS HC $3.75 CSCL 04B

Nimbus 5 satellite data and its use to study climate and develop climate model experiments are examined. Data cover: (1) physical basis for understanding long range and climate monitoring and prediction problem, (2) delineating energy loss to space between contributions from land, ocean, and atmosphere, (3) temporal and spatial distribution in earth's energy budget and its variations due to global cloud fields, and (4) studies of the frequency of occurrence of precipitation over ocean areas. Author

N75-16184# National Climatic Center, Asheville, N.C.
HIGH ALTITUDE METEOROLOGICAL DATA, VOLUME 9, NO. 1, JANUARY 1972
1974 242 p
Avail: NTIS MF $2.25; National Climate Center, Federal Building, Asheville, N. C. 28801. Attn: Publications HC $4.35

Wind and temperature measurements from all available meteorological sounding rocket firings are presented, along with computed values for pressure, density, and speed of sound. Local radiosonde observations, and current month means and standard deviations are also presented. Author

N75-16185# National Climatic Center, Asheville, N.C.
HIGH ALTITUDE METEOROLOGICAL DATA, VOLUME 9, NO. 2, FEBRUARY 1972
1974 226 p
Avail: NTIS HC $2.25; National Climate Center, Federal Building, Asheville, N. C. 28801. Attn: Publications HC $4.35
For abstract, see N75-16184.

N75-16186# National Oceanic and Atmospheric Administration, Washington, D.C. Center for Experiment Design and Data Analysis.
WATER-VAPOR AND MASS DIVERGENCE COMPUTATIONS BASED ON BOMEX AIRCRAFT AND RAWINSONDE DATA: A COMPARISON
Robert W. Reeves Dec. 1974 28 p refs
(NOAA-TM-EDS-BOMAP-13) Avail: NTIS HC $3.75

Water-vapor and mass divergences were computed from aircraft and rawinsonde data collected during the Barbados Oceanographic and Meteorological Experiment (BOMEX) in 1969. The contribution to the water-vapor flux divergence by horizontal subgrid-scale eddies was found to be unimportant during undisturbed weather conditions. Correlation coefficients and rms differences between measurements of the same horizontal wind derivatives by different systems are discussed. Results indicate that divergence computations based on data from a single four-aircraft mission are comparable in accuracy to those based on rawinsonde data averaged over four release times and 50 mb. Author

N75-16187 National Environmental Satellite Service, Washington, D.C.
ENVIRONMENTAL SATELLITE IMAGERY: KEY TO METEOROLOGICAL RECORDS DOCUMENTATION NO 5.4
Environ. Data Serv. Nov. 1974 99 p refs
Avail: NTIS HC $4.75

Current cloud data obtained by NOAA's operational environmental satellites is described. Daily global satellite imagery is presented in condensed form as a guide to data stored in NOAA archive, and is designed to assist users in selecting data for research and climatological use. Operational data from the scanning radiometers of NOAA 2 and subsequent NOAA environmental satellites is documented. Author

N75-16188+ National Environmental Satellite Service, Washington, D.C.
ENVIRONMENTAL SATELLITE IMAGERY, NOVEMBER 1974 Key to Meteorological Records Documentation No 5.4
Jan. 1975 96 p refs
Avail: NTIS HC $4.75

Daily mosaics are presented for the Northern and Southern Hemispheres. These were prepared from data swaths by a scanning radiometer on the NOAA 2 satellite. Author

N75-16189# Argonne National Lab., Ill. Environmental Statement Project (ESP)
METEOROLOGY, COOLING TOWERS, AND ENVIRONMENTAL IMPACT STATEMENTS
J. E. Carson 1974 5 p refs Presented at Symp. on Atmospheric Diffusion and Air Pollution, Santa Barbara, Calif., 13 Sep. 1974 Sponsored by AEC
(Conf-740922-2) Avail: NTIS HC $3.25

Alternate wet cooling systems are effective heat sinks, which

reduce the impact of thermal discharges on major water bodies. The environment effects which they create are considered minor for the isolated site required for the exclusion area of a nuclear plant. It is indicated that quantitative data obtained from field operations on the effects of operation of the various cooling systems are needed so that the utilities and regulatory agencies may accurately weigh the advantages and disadvantages and select the best system for the site. The main areas of insufficient knowledge are the extent and impact of fogging and icing, plume rise, drift effects and SO2 - plume interactions that could cause acid misting. Cooling system effects include mesoscale weather changes, critical heat release rates for a given location, consumptive water use, and the spread of pathogens and condensation nuclei. Author (NSA)

N75-16190# California Univ., Livermore. Lawrence Livermore Lab.

ONE-DIMENSIONAL MODEL OF PRECIPITATION SCAVENGING

C. R. Molenkamp Jul. 1974 14 p refs Presented at Conf. on Cloud Phys., Tucson, Ariz., 21 Oct. 1974 Sponsored by AEC

(UCRL-75603; Conf-741016-1) Avail: NTIS HC $3.25

The model convective cloud does not efficiently scavenge small particles unless they are initially near or below cloud base and they are active condensation nuclei. But when these conditions are met, precipitation scavenging of toxic materials produces deposition amounts comparable to the amount of toxic material in a vertical column of the undisturbed environment in the vicinity of the convective cloud. Author (NSA)

N75-16191# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.

ACTUAL STANDARD DEVIATIONS OF VERTICAL AND HORIZONTAL WIND DIRECTION COMPARED TO ESTIMATES FROM OTHER MEASUREMENTS

M. M. Pendergast and T. V. Crawford 1974 22 p refs Presented at the Symp. on Atmospheric Diffusion and Air Pollution, Santa Barbara, Calif., 9-13 Sep. 1974

(Contract AT(07-2)-1)

(DP-MS-74-19; Conf-740922-5) Avail: NTIS HC $3.25

Meteorological data were collected near the Savannah River Plant and were used to assess the applicability of techniques for determining standard deviations of horizontal and vertical wind direction for 1-h periods. During the 2-week sampling period data were collected at 0.25 intervals. During the 6-month sampling period, data were collected at 5.0s intervals. The results of the data analysis are presented. The magnitudes of the standard deviations are used for the determination of coefficients for the calculation of downwind concentrations of air borne contaminants. Author (NSA)

N75-16192# Colorado State Univ., Fort Collins. Natural Resources Ecology Lab.

WEATHER MODIFICATION-RELATED UNCERTAINTIES IN ECOLOGICAL AND AGRICULTURAL SYSTEMS IN THE HIGH PLAINS: SCIENTIFIC APPRAISAL AND RECOMMENDED RESEARCH, VOLUME 1 Final Report, 10 Dec. 1973 - 31 Jul. 1974

31 Jul. 1974 153 p refs

(Contract DI-14-06-D-7519)

(PB-235033/8; REC-14-06-D-7519) Avail: NTIS HC $6.25 CSCL 04B

The report includes a multidisciplinary appraisal of weather modification-related uncertainties in ecological and agricultural systems in the high plains, with respect to a five to seven year weather modification experiment. Ecological and agricultural systems regarded as being causally coupled with hydrologic and seeding agent systems are directly coupled with economic and social systems. GRA

N75-16193# Naval Postgraduate School, Monterey, Calif.

A SYNTHESIS OF THE ELEMENTS OF RANDOM-SHIP SYNOPTIC REPORTS TO DERIVE CLIMATOLOGICAL MARINE-FOG FREQUENCIES M.S. Thesis

Ronald Earl Englebretson Sep. 1974 69 p refs

(AD-787437) Avail: NTIS CSCL 04/2

Published climatologies of marine-fog frequencies are in disagreement for common areas, although the nature and magnitude of errors are difficult to assess since actual frequencies for specific locations may be derived only from observations at Ocean Stations. This study presents a method of synthesizing the elements of surface-ship synoptic reports into a computerized scheme for the purpose of deriving frequencies of marine fog occurrence. The program, based on a liberal interpretation of reporting guidelines in the Synoptic Code Manual, uses 16 combinations of present and past weather, and visibility, to identify fog in the reports. The program then objectively assigns the duration of fog for the three- or six-hour period represented by the synoptic report. A prototype climatology of marine-fog occurrence is derived for July, over the eastern North Pacific Ocean. (Modified author abstract) GRA

N75-16194# RAND Corp., Santa Monica, Calif.

CHROMATIC DISPLAY OF DIGITAL WEATHER DATA

Jeannine V. Lamar and Roy H. Stratton Mar. 1974 31 p refs

(Contract DAHC15-73-C-0181)

(AD-787392; R-1378-ARPA) Avail: NTIS CSCL 04/2

The global circulation model of the Rand Climate Dynamics Study is briefly described. The present method of interpretation of data from this program is discussed; in many cases the hard copy is difficult to interpret because the lines defining the contour intervals overlap, coincide, and become indistinguishable. Some possible alternative or complementary techniques using both pseudocolor and false color for display of these data are presented, in which digital data are transformed to black-and-white intermediate film strips and subsequently combined to produce color images. A method of testing the new techniques to determine their merit is suggested. GRA

N75-16195# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

THE NATURE AND VARIABILITY OF INTEGRATED BOUNDARY LAYER WINDS

Rene V. Cormier 12 Jun. 1974 111 p refs Presented at the 5th Conf. on Weather Forecasting and Analysis of the Am. Meteorol. Soc., St. Louis, 4-7 Mar. 1974

(AF Proj. 8624)

(AD-787706; AFCRL-AFSIG-289; AFCRL-TR-74-0264) Avail: NTIS CSCL 04/2

The surface boundary layer wind was studied by collecting data for the 50 to 1000-ft layer to better understand the integrated boundary layer wind (IBLW) used in air pollution models for urban areas. Time lag variability, effect of averaging, Eulerian and Lagrangian differences, and spatial variability are discussed. It was found that the IBLW has a pronounced diurnal variation linked to sunrise/sunset times, and its behavior is related to the average layer temperature. F.O.S.

N75-16196# Naval Weather Service Command, Washington, D.C.

SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS CARIBBEAN AND NEARBY ISLAND COASTAL MARINE AREAS. VOLUME 1, AREA 1: BRITISH HONDURAS. AREA 2: CIUDAD DEL CARMEN. AREA 3: VERACRUZ. AREA 4: CAPE ROJO. AREA 5: YUCATAN. AREA 6: ISLE OF PINES

Nov. 1974 484 p

(AD-787723) Avail: NTIS CSCL 04/2

The data contained in these tables were obtained from Tape Data Family 11 (TDF-11) Marine Surface Observations. The development and maintenance of TDF-11 was primarily funded by the Naval Weather Service Command. GRA

N75-16197# Environmental Prediction Research Facility (Navy), Monterey, Calif.

USERS GUIDE FOR DIRECT READOUT DATA CONVERTER (DRDC)

G. Hunolt Sep. 1974 131 p

(AD-787480; EPRF-CP-Note-14) Avail: NTIS CSCL 04/2

The DRDC User's Guide describes the use of the DRDC and DRDC support software package to digitize, process, and display NOAA-2/NOAA-3 type direct readout scanning radiometer (DRSR) data. The characteristics of the DRSR data are described. The rectification, enhancement, expansion and calibration functions

of the DRDC support software package are described. Instructions are included for operating the DRDC in digitize and display modes and for setting up the CDC-3100 program runs. Complete documentation of the programs is provided in the form of descriptions and flowcharts. Author (GRA)

N75-16198# Mississippi State Univ., State College. Water Resources Research Inst.
SEVERITY AND FREQUENCY OF DROUGHT IN MISSISSIPPI
John C. McWhorter Jul. 1974 43 p refs
(PB-236419/8; W74-13052) Avail: NTIS HC $3.75 CSCL 04B

Monthly climatological data for Mississippi and a drought model which expressed monthly severity in terms of an index value were used to determine drought periods and to classify their severity for ten geographic areas in the state of Mississippi. The severity data was analyzed in order to determine the return period associated with a specific degree of severity. GRA

N75-15642 Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
WIND CHARACTERISTICS IN THE PLANETARY BOUNDARY LAYER
Henry Rachele and Manuel Armendariz *In* AGARD Effects of Surface Winds and Gusts on Aircraft Design and Operation Nov. 1974 p 1-58 refs (For availability see N75-15641 07-05)

N75-15643 Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
UK RESEARCH ON AERONAUTICAL EFFECTS OF SURFACE WINDS AND GUSTS
J. G. Jones *In* AGARD Effects of Surface Winds and Gusts on Aircraft Design and Operation Nov. 1974 p 59-78 refs (For availability see N75-15641 07-05)

N75-15644 Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala.
USE OF RADIOSONDE DATA TO DERIVE ATMOSPHERIC WIND SHEARS FOR SMALL SHEAR INCREMENTS
Oskar M. Essenwanger *In* AGARD Effects of Surface Winds and Gusts on Aircraft Design and Operation Nov. 1974 p 79-88 refs (For availability see N75-15641 07-05)

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N75-16199*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPLICATION OF MONOCHROMATIC OCEAN WAVE FORECASTS TO PREDICTION OF WAVE-INDUCED CURRENTS
Lamont R. Poole Washington Feb. 1975 26 p refs
(NASA-TN-D-7861; L-9906) Avail: NTIS HC $3.75 CSCL 08C

The use of monochromatic wind-wave forecasts in prediction of wind-wave-induced currents was assessed. Currents were computed for selected combinations of wind conditions by using a spectrum approach which was developed by using the Bretschneider wave spectrum for partially developed wind seas. These currents were compared with currents computed by using the significant and average monochromatic wave parameters related to the Bretschneider spectrum. Results indicate that forecasts of significant wave parameters can be used to predict surface wind-wave-induced currents. Conversion of these parameters to average wave parameters can furnish reasonable estimates of subsurface current values. Author

N75-16200# Florida State Univ., Tallahassee. Dept. of Oceanography.
A DIAGNOSTIC CALCULATION OF CONTINENTAL SHELF CIRCULATION
Chich-Yuan Peng and Ya Hsueh Aug. 1974 169 p refs
(Contract N00014-67-A-0235-0002; Grants NSF GX-33502; NSF GA-29734; NSF GA-26563)
(AD-787740; Rept-128) Avail: NTIS CSCL 08/3

An attempt is made to compute from observed density the three-dimensional velocity field in a continental shelf region that is bounded by the coast on one side and open to the ocean along the rest of its perimeter. The bottom topography of the shelf region is found to be of crucial importance. For a nondimensional depth gradient greater than the square root of the Ekman number, E, based on the vertical eddy viscosity and a scale depth, the isobaths become geostrophic contours in the sense that the barotropic part of the velocity field possesses no component normal to the isobaths. In such case, the flow field everywhere away from the coast is determined once the geostrophic velocity vector becomes known at some reference point along each of the isobaths. (Modified author abstract) GRA

N75-16201# Old Dominion Univ., Norfolk, Va. Inst. of Oceanography.
VARIATIONS IN BOUNDARY DRAG COEFFICIENT IN THE TIDAL ENTRANCE TO CHESAPEAK BAY, VIRGINIA
John C. Ludwick Aug. 1974 26 p refs
(Contract N00014-70-C-0083; NR Proj. 388-08)
(AD-787846; TR-19) Avail: NTIS CSCL 08/3

Use of the quadratic shear stress law for estimating boundary drag requires specific knowledge of the magnitude of a drag coefficient, and sectional mean velocity. In previous attempts to adapt the relationship for use in marine sediment transport studies, the flow measurement has been standardized at a level 100 cm above the bed. The particularized value of the drag coefficient has been designed as C(100). In the entrance area to Chesapeake Bay, Virginia, C(1 00) has been found to range over unacceptably wide limits. Two-thirds of the values obtained are between 0.0035 and 0.054. Mean C(100) for the area is 0.013 as compared to 0.003 for tidal channels within Puget Sound, Washington. Present data suggest that given a moveable bed, a size hierarchy of mobile bed forms, time varying flow, and a lack of equilibrium between flow and bed, C(100) changes continuously with the flow. Accurate evaluation of boundary shear stress in tidal entrances with high flow rates and mobile beds presently requires measurement of velocity profiles. Author (GRA)

N75-16202# Rosenstiel School of Marine and Atmospheric Sciences, Miami, Fla.
COASTAL UPWELLING EXPERIMENT. 1: PROFILING CURRENT METER DATA REPORT. R/V YAQUINA CRUISE Y7207-E (31 JULY - 7 AUGUST 1972). R/V CAYUSE CRUISES C7208-F1 AND C7208-F2 (15-18 AUGUST AND 21-24 AUGUST 1972)
Thomas B. Curtin and Christopher N. K. Mooers Apr. 1974 130 p refs
(Grant NSF GX-31264)
(PB-235933/9; UM-RSMAS-74015) Avail: NTIS HC $5.75 CSCL 08C

The report includes data acquired during the summer of 1972 on one cruise of the R/V YAQUINA (Y7207-E, 31 July to 7 August) and two cruises of the R/V CAYUSE (C7208-F1, 15-18 August; and C7208-F2, 21-24 August). These cruises constituted part of the first Coastal Upwelling Experiment, (CUE-I), a multi-institutional program sponsored by the Office for the International Decade of Ocean Exploration, National Science Foundation, to study upwelling off the Oregon coast. Information is given on procedures and data graphics. Charts and tables are included. GRA

N75-16203# Rosenstiel School of Marine and Atmospheric Sciences, Miami, Fla.
COASTAL UPWELLING EXPERIMENT. 1: HYDROGRAPHIC DATA REPORT. R/V CAYUSE CRUISES C7208-F1 AND C7208-F2 (15-19 AUGUST AND 21-25 AUGUST 1972)
Thomas B. Curtin and Christopher N. K. Mooers Feb. 1974 75 p refs
(Grant NSF GX-31264)
(PB-235937/0; UM-RSMAS-74003; NSF/IDOE-74-29) Avail: NTIS HC $4.25 CSCL 08C

Data are reported from two cruises of the R/V Cayuse during the summer of 1972: 15-19 August (C7208-F1) and 21-25 August (C7208-F2). These cruises constituted part of the

first Coastal Upwelling Experiment (CUE-I), a multi-institutional program sponsored by the Office for the International Decade of Ocean Exploration, National Science Foundation, to study coastal upwelling off Oregon. Detailed hydrographic and current profiles in a coastal upwelling frontal zone were made. This report contains the hydrographic data obtained with the STD system. GRA

N75-16204# Nova Univ., Dania, Fla. Physical Oceanographic Lab.
DEVELOPMENT OF A SYSTEM FOR MEASUREMENT OF SURFACE CURRENTS AND OCEANIC CURRENT OBSERVATIONS Final Report, Oct. 1971 - Jan. 1974
William S. Richardson Feb. 1974 94 p refs
(Contract DOT-DG-20859-A)
(AD-787787; USCG-D-18-75; CGR/DC-1/74) Avail: NTIS CSCL 08/3

The report contains a description of modifications and improvements to expendable probes for the measurement of oceanic currents from aircraft. These probes were used in the study of currents along eleven sections on the southeast coast of Florida. The results of the study are presented. A manual for the operational use of the probe was prepared. Author (GRA)

N75-16205# Ocean Engineering Information Service, La Jolla, Calif.
COASTAL-ESTUARINE AND NEARSHORE PROCESSES, AN ANNOTATED BIBLIOGRAPHY
Evelyn Sinha and Bonnie McCosh Jun. 1974 323 p refs
(Contract DI-14-31-0001-9090)
(PB-236006/3; WRSIC-74-207; OWRR-W169(1); W74-12351) Avail: NTIS HC $9.25 CSCL 08J

A total of 1009 annotated references to the literature on coastal-estuarine and nearshore processes is presented. The geologic, geomorphic, meteorologic, and oceanographic referer ces which deal with the highly variable interactions in the estuarine and in the nearshore zone are identified by a subject outline along with models, methods, and instruments used in the study of coastal processes. References to studies in various parts of the world are specified in the geographic outline. The list of bibliographies included references to true bibliographies as well as to documents which contain 50 or more substantive references. GRA

N75-16428* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EARTH AND OCEAN PHYSICS
In its Significant Accomplishments in Sci. and Technol. 1975 p 234-249 (For availability see N75-16422 07-88)
CSCL 08J

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N75-16206*# National Aeronautics and Space Administration. National Space Technology Labs., Bay Saint Louis, Miss.
AQUATIC PLANTS FOR REMOVAL OF MEVINPHOS FROM THE AQUATIC ENVIRONMENT
B. C. Wolverton Feb. 1975 8 p refs
(NASA-TM-X-72720) Avail: NTIS HC $3.25 CSCL 06C

Fragrant waterlily (Nymphaea odorata, Ait.), joint-grass (Paspalum distichum L.), and rush (Juncus repens, Michx.) were used to evaluate the effectiveness of vascular aquatic plants in removing the insecticide mevinphos (dimethyl-1-carbomethoxy-1propen-2-yl phosphate) from waters contaminated with this chemical. The emersed aquatic plants fragrant waterlily and joint-grass removed 87 and 93 ppm of mevinphos from water test systems in less than 2 weeks without apparent damage to the plants; whereas rush, a submersed plant, removed less insecticide than the water-soil controls. Water-soil control still contained toxic levels of this insecticide, as demonstrated by fish bioassay studies, after 35 days. Author

N75-16207# Aerospace Corp., El Segundo, Calif. Labs. Operation.
DESORPTIVE TRANSFER: A MECHANISM OF CONTAMINANT TRANSFER IN SPACECRAFT Interim Report
H. K. Alan Kan 9 Oct. 1974 16 p
(Contract F04701-74-C-0075)
(AD-787857; TR-0075(9270-02)-1; SAMSO-TR-74-228) Avail: NTIS CSCL 07/4

The transfer of contaminants in spacecraft by desorption is examined. In this mechanism, contaminants are transferred in an apparent non-line-of-sight manner by first being adsorbed on and subsequently desorbed from a transfer surface. The parameters governing the kinetics of contaminant build-up on a collector surface are determined and discussed. (Modified author abstract) GRA

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N75-16208*+ National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 133)
Oct. 1974 89 p
(NASA-SP-7011(133)) Avail: NTIS HC $4.00 CSCL 06E

This special bibliography lists 276 reports, articles, and other documents introduced into the NASA Scientific and Technical Information System in September 1974. Author

N75-16209*+ National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 135)
Dec. 1974 82 p
(NASA-SP-7011(135)) Avail: NTIS HC $4.00 CSCL 06E

This special bibliography lists 268 reports, articles, and other documents introduced into the NASA Scientific and Technical Information System in November 1974. Author

N75-16210*+ National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 134)
Nov. 1974 92 p
(NASA-SP-7011(134)) Avail: NTIS HC $4.00 CSCL 06E

This special bibliography lists 301 reports, articles, and other documents introduced into the NASA Scientific and Technical Information System in October 1974. Author

N75-16211*# Tennessee Univ., Memphis. Materials Science Toxicology Labs.
TOXICITY OF THE PYROLYSIS PRODUCTS OF SPACECRAFT MATERIALS Annual Report, 1 Aug. 1973 - 30 Nov. 1974
W. H. Lawrence 25 Nov. 1974 72 p
(Contract NAS9-13617)
(NASA-CR-141497) Avail: NTIS HC $4.25 CSCL 06E

A number of spacecraft construction materials are evaluated for the toxic effects of their thermodegradation products on rats. Pyrolysis toxicity testing of pyrolysate fumes establish carbon monoxide, carbon dioxide and hydrogen cyanide as the most common intoxicating agents. Generally, COHb levels of animals expiring in the test chamber suggest higher concentrations of CO are produced with larger samples of most materials. G.G.

N75-16212*# Washington Univ., Seattle. Nuclear Medicine Div.
TOTAL BODY CALCIUM ANALYSIS Annual Report, 1 Nov. 1972 - 1 Oct. 1974
Tom K. Lewellen and W. B. Nelp 9 Nov. 1974 46 p refs
(Contract NAS9-13029)
(NASA-CR-141573) Avail: NTIS HC $3.75 CSCL 06P

A technique to quantitate total body calcium in humans is developed. Total body neutron irradiation is utilized to produce

argon 37. The radio argon, which diffuses into the blood stream and is excreted through the lungs, is recovered from the exhaled breath and counted inside a proportional detector. Emphasis is placed on: (1) measurement of the rate of excretion of radio argon following total body neutron irradiation; (2) the development of the radio argon collection, purification, and counting systems; and (3) development of a patient irradiation facility using a 14 MeV neutron generator. Results and applications are discussed in detail. J.M.S.

N75-16213*# Grambling State Univ., La. Dept. of Physics.
LYMPHOID CELL KINETICS UNDER CONTINUOUS LOW DOSE-RATE GAMMA IRRADIATION: A COMPARISON STUDY Semiannual Status Report
Bessie Ruth Foster 12 Feb. 1975 15 p refs
(Grant NsG-9014)
(NASA-CR-142068) Avail: NTIS HC $3.25 CSCL 06E

The mechanism of cell proliferation is studied in the lymphoid tissue of the mouse spleen under the stress of continuous irradiation at a dose-rate of 10 roentgens per day for 105 days. Autoradiography and specific labeling with tritiated thymidine were utilized. It was found that at least four compensatory mechanisms maintained a near-steady state of cellular growth: (1) an increase in the proportion of PAS-positive cells which stimulate mitotic activity, (2) maturation arrest of proliferating and differentiating cells which tend to replenish the cells damaged or destroyed by irradiation, (3) an increase in the proportion of cells proliferating, and (4) an increase in the proportion of precursor cells.The results are compared to previous findings obeserved in the thymus. N.E.R.

N75-16214# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
NUCLEAR-POWERED ARTIFICIAL HEART PROTOTYPE SYSTEM DEVELOPMENT PROGRAM: PHASE 3 Quarterly Progress Report, 1 Apr. - 30 Jun. 1974
1974 165 p
(Contract AT(11-1)-3043)
(COO-3043-16) Avail: NTIS HC $6.25

Thermal insulation component development continued. The 26 skirted cup test insulation package was assembled and tested. The guarded heater insulation test stands were evaluated. Thermal converter development was continued on five specific components; hot finger, control valve, oil pump, bellows seals, and shaft seals. Blood pump drive mechanism component development progress is discussed. The design of the IVBM thermal converter was completed and is described. The blood pump drive mechanism design was completed and most of the components were released for manufacture or purchase. Progress in the fabrication of the insulation cups and fluff foil is reported. The 60 cup electrical IVBM insulator package was manufactured, assembled, and placed on test. Procurement action was initiated for the blood pump drive mechanism fabrication effort and for the auxiliary components. Author (NSA)

N75-16215# California Univ., Berkeley. Dept. of Mechanical Engineering.
AN ENGINEERING ANALYSIS OF THE HUMAN SPINAL COLUMN Final Report
Robert F. Steidel, Jr. and Keith Markolf 1974 103 p refs
(Grant SRS-RD-3548)
(PB-235383/7) Avail: NTIS HC $5.25 CSCL 06B

The spinal column was studied as an engineering structure, and this analysis was applied to the specific problem of spinal bracing. There are two key areas of importance in spinal mechanics: (1) the definition of forces, moments, or systems of forces and moments acting upon the spinal column, and (2) the deformation of the intervertebral joint, under load. The experimental data were used to design and construct a mechanical model instrumented to measure relative rotation at the intervertegral joint levels. The model spine was then inserted into a plastic body jacket and internally inflated into a mock-up of a human torso. Bending tests were performed both with this torso alone and with the torso and a lumbosacaral corset or chairback brace. GRA

N75-16216# School of Aerospace Medicine, Brooks AFB, Tex.
CIRCADIAN VARIATIONS IN RENAL EXCRETION OF MAGNESIUM, CALCIUM, AND PHOSPHORUS DURING A 3-DAY FLIGHT Final Report, Dec. 1970 - Dec. 1971
Carl L. Giannetta and Vishnampet S. Jayanthinathan Sep. 1974 11 p refs
(AF Proj. 7930; AF Proj. 62202F)
(AD-787661; SAM-TR-74-38) Avail: NTIS CSCL 06/19

The effect of a 3-day flight on the excretion of calcium, magnesium, and inorganic phosphorus in the urine of C-5 crewmembers was studied. The excretion rate of the minerals was analyzed for evidence of circadian rhythm. Magnesium showed a significant ($P < .05$) day/time interaction during the flight and day-to-day variation ($P < .05$) during the recovery. Phosphorus had a significant time-of-day variation ($P < .05$). The day-to-time and day-to-day variations for calcium were of borderline significance. Author (GRA)

N75-16217# Naval Submarine Medical Research Lab., Groton, Conn.
BIOCHEMICAL RESPONSES OF MEN TO SIMULATED AIR DIVES OF 100 FEET Interim Report
Donald V. Tappan and Elly Heyder 19 Mar. 1974 14 p refs
(MR0410601)
(AD-787066; NSMRL-774) Avail: NTIS CSCL 06/19

Six men were subjected to a simulated dive in air to 100 FSW for one hour followed by a 70-minute decompression. Total 24 hour excretions of 12 urinary parameters were measured for two days prior to and 11 days following the dives. Blood serum constituents were determined in pre-dive samples, in samples taken immediately upon reaching the surface and in sera obtained for 9 post-dive days. Urinary hydroxyproline increased on the 7th day while phosphorus decreased on the 6, 8, and 9th days post-dive. Serum electrolyte imbalance occurred during the first 24 hours after the dive and again on the 7th day. The first episode results primarily from low potassium excretion while the second from a high sodium output. The present findings provide tentative evidence that recovery periods of 7-9 days may necessarily follow shallow or medium depth dives. (Modified author abstract) GRA

N75-16218# Naval Submarine Medical Research Lab., Groton, Conn.
HEMOSTATIC ALTERATIONS FOLLOWING SEVERE DYSBARIC STRESS Medical Research Progress Report
Michael J. Jacey, Richard O. Madden, and Donald V. Tappan 12 Feb. 1974 15 p refs
(AD-787065; NSMRL-773; PR-3) Avail: NTIS CSCL 06/19

Hemostatic parameters were measured in the blood of mature Sprague Dawley rats during a three-day period following exposure to a compression-decompression schedule designed to produce severe dysbaric stress. The animals were compressed on air to 300 feet of sea water for 30 minutes and stage decompressed over a 42-minute interval. Acute decompression stress produced a transient decrease in clotting time. Circulating platelet population was unchanged during the early phase of recovery from severe decompression but significantly declined by two days post-surfacing and then returned to control levels by the end of the observation period. Associated with this thrombocytopenic episode was a tendency toward platelet aggregation. Core temperature measurements indicated the presence of a chronic hyperthermic condition. A significant hyperfibrinogenemia developed by one day post-dive with a normalization of fibrinogen content occurring during the following two days. No alterations in either prothrombin time or partial thromboplastic time were detected. This animal research has much significance in the biomedical aspects of human diver safety and health.
Author (GRA)

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N75-16219*# Stanford Research Inst., Menlo Park, Calif.
EFFECTS ON SLEEP OF NOISE FROM TWO PROPOSED STOL AIRCRAFT Final Contractor Report

Jerome S. Lukas, D. J. Peeler, and J. E. Davis Jan. 1975 31 p refs
(Contract NAS1-12378; SRI Proj. 2871)
(NASA-CR-132564) Avail: NTIS HC $3.75 CSCL 05E

Responses, both overt behavior and those measured by electroencephalograph, to noise by eight male subjects were studied for sixteen consecutive nights. Test stimuli were: (1) The simulated sideline noise of a short takeoff and landing aircraft with blown flaps; (2) the simulated sideline noise of a STOL aircraft of turbofan design; (3) the simulated takeoff noise of the blown flap STOL aircraft; and (4) a four second burst of simulated pink noise. Responses to each noise were tested at three noise intensities selected to represent levels expected indoors from operational aircraft. The results indicate that the blown flap STOL aircraft noise resulted in 8 to 10 percent fewer sleep disturbance responses than did the turbofan STOL aircraft when noises of comparable intensities from similar maneuvers were used. Author

N75-16220*# Bolt, Beranek, and Newman, Inc., Los Angeles, Calif.
EFFECT OF CESSATION OF LATE-NIGHT LANDING NOISE ON SLEEP ELECTROPHYSIOLOGY IN THE HOME Final Report
Karl S. Pearsons, Sanford Fidell, Ricarda L. Bennett, Joyce Friedman (Calif. Univ., Irvine), and Gordon Globus (Calif. Univ., Irvine) Dec. 1974 35 p refs
(Contract NAS1-12261)
(NASA-CR-132543; Rept-2602) Avail: NTIS HC $3.75 CSCL 05E

Simultaneous measurements of noise exposure and sleep electrophysiology were made in homes before and after cessation of nighttime aircraft landing noise. Six people were tested, all of whom had been exposed to intense aircraft noise for at least two years. Noise measurements indicated a large reduction in the hourly noise level during nighttime hours, but no charge during the daytime hours. Sleep measures indicated no dramatic changes in sleep patterns either immediately after a marked change in nocturnal noise exposure or approximately a month thereafter. No strong relationship was observed between noise level and sleep disturbances over the range from 60 to 90 db(A). Author

N75-16221# Rochester Univ., N.Y. Dept. of Radiation Biology and Biophysics.
SENSATION AND PERCEPTION OF MICROWAVE ENERGY
Sol M. Michaelson 1974 12 p refs Presented at the 7th Intern. Conf. on Environ. Toxicity: Fundamental and Applied Aspects of Nonionizing Radiation, Rochester, N. Y., 5 Jun. 1974 Sponsored by AEC and Dept. of Navy
(Contract FDA 73-30)
(UR-3490-550; Conf-740658-1) Avail: NTIS HC $3.25

Sensing or perception of microwave/radiofrequency energy is accomplished through various mechanisms. In mammals, the main phenomena of sensation or perception are those of thermal sensations and, in selected cases, audition. Thermal sensation is accomplished by stimulation of thermosensitive nerve endings in the skin. Although some investigators believe that hearing or audition is evidence of direct nerve stimulation, the most recent data show this phenomena to be due to electromechanically induced vibrations in tissue and normal reception in the cochlea of the ear. Author (NSA)

N75-16222# California Univ., Torrance. Dept. of Psychiatry.
CHEMICAL INDEX TO FITNESS (BIOCHEMICAL CORRELATES OF STRESS IN SPECIALIZED POPULATIONS) Final Report, Sep. 1973 - Aug. 1974
Robert T. Rubin 1 Nov. 1974 9 p refs
(Contract N00014-73-C-0127; NR Proj. 108-912; NR Proj. 202-004)
(AD-787824) Avail: NTIS CSCL 05/10

The report discusses studies on the characteristics of the release of both anterior and posterior pituitary hormones as well as their target organ hormones, in human subjects under several different conditions of central nervous system activity. These studies are encompassing the biorhythms of these hormones and the specific interrelationships of pituitary hormones interacting on their target organ glands. GRA

N75-16223# Human Engineering Labs., Aberdeen Proving Ground, Md.
THE INFLUENCE OF SIMULTANEOUS AND SEQUENTIAL DISPLAY MODES ON HUMAN INFORMATION-TRANSFER BEHAVIOR Final Report
Eckhard Behr Aug. 1974 47 p refs
(AD-787288; HEL-TM-18-74) Avail: NTIS CSCL 05/10

The experiment investigated how two display modes affect human information-transfer performance. Subjects read test numbers from a cathode-ray tube and entered them into a keyboard. The numbers appeared either one digit after another (sequentially) or all digits at once (simultaneously). There were three number-lengths (four, six, and eight digits) and three exposure times (100, 500, and 1000 msec.). Performance was evaluated from errors and response times, and subjects transfer strategies were examined. Simultaneous displays transferred digits more effectively than sequential ones. Performance was better with shorter numbers or longer exposure times. Subjects transferred only four to five digits accurately, and only when the exposure time was 500 msec. or longer. Their channel capacity approximated 13 bits. Author (GRA)

N75-16224# University of Southern Calif., Los Angeles.
BUILDING A DISTANCE FUNCTION FOR GESTALT GROUPING Final Report, 1 Jul. 1972 - 31 Aug. 1974
Albert L. Zobrist, Robert E. Kalaba, and William Thompson 1974 6 p refs
(Grant DA-ARO(D)-31-124-72-G200)
(AD-787525; AROD-10708-4-EL) Avail: NTIS CSCL 09/2

The authors have devised and studied a method of combining multiple cues for grouping. A standardized scene has been used to eliminate the semantic problem so that the interaction of texture, brightness, and color could be studied. The primary goal of the research has been to simulate human performance as closely as possible. A secondary goal is the development of a useful and orderly methodology for this area of research. Author (GRA)

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N75-16225*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PRELIMINARY FLIGHT TESTS OF AN OCULOMETER
D. B. Middleton, G. J. Hurt, Jr., M. A. Wise, and J. D. Holt Nov. 1974 32 p refs
(NASA-TM-X-72621) Avail: NTIS HC $3.75 CSCL 06B

A remote sensing oculometer has been successfully operated during flight tests. This device was able to track the pilot's eye-point-of-regard (lookpoint) consistently and unobtrusively in the flight environment. The instantaneous position of the lookpoint was determined to within approximately 1 degree. Data were recorded on both analog and video tape. The video data consisted of continuous scenes of the aircraft's instrument display and a superimposed white dot (simulating the lookpoint) dwelling or moving from instrument to instrument as the pilot monitored the display information during landing approaches. Author

N75-16226*# URS/Matrix Co., Huntsville, Ala. Man Systems Div.
AN EVALUATION OF THE ATM MAN/MACHINE INTERFACE. PHASE 3: ANALYSIS OF SL-3 AND SL-4 DATA Final Report
James R. Bathurst, Jr., Richard F. Pain, and Dana B. Ludewig Dec. 1974 148 p refs
(Contract NAS8-25627)
(NASA-CR-120586; DCN-1-4-50-42583(1F)) Avail: NTIS HC $5.75 CSCL 05H

The functional adequacy of human factored crew operated

systems under operational zero-gravity conditions is considered. Skylab ATM experiment operations generated sufficient telemetry and voice transcript data to support such an assessment effort. Discussions are presented pertaining to the methodology and procedures used to evaluate the hardware, training and directive aspects of Skylab 3 and Skylab 4 manned ATM experiment operations. Author

N75-16227*# Pillsbury Mills, Inc., Minneapolis, Minn.
SPACE SHUTTLE/FOOD SYSTEM STUDY Final Report
1974 48 p refs Prepared Jointly with Fairchild Republic Co.
(Contract NAS9-13138)
(NASA-CR-141482) Avail: NTIS HC $3.75 CSCL 06H

This document establishes the functional, physical and performance interface requirements are studied between the space shuttle orbiter and the galley water system, the orbiter and the galley electrical system, and the orbiter and the galley structural system. Control of the configuration and design of the applicable interfacing items is intended to maintain compatibility between co-functioning and physically mating items and to assure those performance criteria that are dependent upon the interfacing items. Author

N75-16228*# Chemtric, Inc., Rosemont, Ill.
ADVANCE PROTOTYPE SILVER ION WATER BACTERICIDE SYSTEM Final Report, Sep. 1973 - Jun. 1974
W. J. Jasionowski and E. T. Allen Dec. 1974 102 p refs
(Contract NAS9-13718)
(NASA-CR-141557; FR-3104) Avail: NTIS HC $5.25 CSCL 06K

An advance prototype unit was designed and fabricated to treat anticipated fuel cell water. The unit is a single canister that contains a membrane-type prefilter and a silver bromide contacting bed. A seven day baseline simulated mission test was performed; the performance was satisfactory and the effluent water was within all specifications for potability. After random vibrations another seven day simulated mission test was performed, and results indicate that simulated launch vibrations have no effects on the design and performance of the advanced prototype. Bench tests and accelerated breadboard tests were conducted to define the characteristics of an upgraded model of the advance prototype unit which would have 30 days of operating capability. A preliminary design of a silver ion generator for the shuttle orbiter was also prepared. Author

N75-16229*# Spectrix Corp., Houston, Tex.
POTABLE WATER TASTE ENHANCEMENT Final Report
Dec. 1974 64 p refs
(Contract NAS9-12969)
(NASA-CR-141577) Avail: NTIS HC $4.25 CSCL 06K

An analysis was conducted to determine the causes of and remedies for the unpalatability of potable water in manned spacecraft. Criteria and specifications for palatable water were established and a quantitative laboratory analysis technique was developed for determinig the amounts of volatile organics in good tasting water. Prototype spacecraft water reclamation systems are evaluated in terms of the essential palatability factors. N.E.R.

N75-16230*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex.
ADVANCE CREW PROCEDURES DEVELOPMENT TECHNIQUES: PROCEDURES GENERATION PROGRAM REQUIREMENTS DOCUMENT
J. D. Arbet, R. L. Benbow and M. L. Hawk 20 Dec. 1974 26 p ref
(Contract NAS9-14354)
(NASA-CR-141561; MDC-W1006) Avail: NTIS HC $3.75 CSCL 05H

The Procedures Generation Program (PGP) is described as an automated crew procedures generation and performance monitoring system. Computer software requirements to be implemented in PGP for the Advanced Crew Procedures Development Techniques are outlined. N.E.R.

N75-16231*# Pillsbury Mills, Inc., Minneapolis, Minn.
SPACE SHUTTLE/FOOD SYSTEM STUDY. PACKAGE FEASIBILITY STUDY, MODIFICATIONS 3S, 4C AND 5S Final Report
[1974] 41 p Prepared in cooperation with Fairchild Republic Div.
(Contract NAS9-13138)
(NASA-CR-141483) Avail: NTIS HC $3.75 CSCL 06H

An optimum feeding system for the space shuttle was presented. This system consisted of all rehydratable type foods which were enclosed in a 4 in. x 4 in. x 1 in. flexible package. A feasibility follow-on study was conducted, and two acceptable, feasible prototypes for this package are described. Author

N75-16232*# Pillsbury Mills, Inc., Minneapolis, Minn.
SPACE SHUTTLE/FOOD SYSTEM STUDY. REQUIREMENTS DOCUMENT, MODIFICATIONS 3S, 4C AND 5S Final Report
[1974] 48 p refs Prepared in cooperation with Fairchild Republic Div.
(Contract NAS9-13138)
(NASA-CR-141484) Avail: NTIS HC $3.75 CSCL 06H

Design specifications are enumerated for a galley subsystem which will provide a centralized location for performing all food related functions (except dining) within the space shuttle orbiter. N.E.R.

N75-16233# Utah Univ., Salt Lake City.
BIOMEDICAL ENGINEERING SUPPORT Quarterly Report, 16 Feb. - 15 May 1974
L. M. Smith and G. M. Sandquist 15 May 1974 86 p refs
(Contract AT(11-1)-2155)
(COO-2155-12; QR-3) Avail: NTIS HC $4.75

During the reporting period a fit trial experiment was conducted to determine and evaluate the accommodation in a calf of the proposed Westinghouse blood pump drive train and electric motor configuration. The proposed system would permit exchange of the electric motor with the plutonium loaded thermal converter sometime after total heart replacement had occurred and the calf was convalescing. Modifications were made and a tentative drive train system was established which would permit successful interchange of the electric motor and thermal converter. Author

N75-16234# Manned Systems Sciences, Inc., Northridge, Calif.
TRAINEE PERFORMANCE MEASUREMENT DEVELOPMENT USING MULTIVARIATE MEASURE SELECTION TECHNIQUES Final Report, Dec. 1972 - Dec. 1973
Donald Vreuls, Richard W. Obermayer, and Ira Goldstein Sep. 1974 52 p refs
(Contract N61339-73-C-0066; ARPA Order 2310)
(AD-787594; NAVTRAEQUIPC-73-C-0066-1) Avail: NTIS CSCL 05/9

A study was conducted to extend a descriptive structure for measuring human performance during training to a fixed-wing, high-performance aircraft simulation, and to develop measure selection statistical techniques. The effort required (1) definition of candidate performance measures for the simulated flight task, (2) development of computer programs to acquire raw data and produce candidate measures for 18, one-hour training sessions with four participants, and (3) most especially, to develop methods to reduce the resulting candidate measures to a small and efficient set which reflects the skills change that occurs as a function of training. It was desired that the resultant measurement have the capability of discriminating between different levels of proficiency and predicting later performance based on measures of current performance. Two measure selection methods which were developed and the results of applying them are discussed. (Modified author abstract) GRA

N75-16235# Naval Air Development Center, Warminster, Pa. Crew Systems Dept.
THE ENCAPSULATING LIFE RAFT SYSTEM
Craig S. Jencks and David N. DeSimone 1 May 1974 24 p refs
(AD-787637; NADC-74103-40) Avail: NTIS CSCL 06/7

The encapsulating life raft system has been developed as an emergency flotation platform for the purpose of substantially increasing water survivability for downed aircrewmen of ejection seat type aircraft. Actuation of this life raft system during parachute descent results in the aviator becoming rapidly and

completely enclosed within the raft system, prior to water impact. Water immersion of the aviator is effectively prevented thereby greatly eliminating the survival hazards associated with parachute entanglement, raft boarding, and physiological degradation caused by cold water exposure. With the demonstrated ability of this system to prevent water immersion of the man, this life raft has been made an essential component in the development of a passive, fully integrated survival system that expectantly will eliminate the need for cumbersome cold weather anti-exposure garments. Verification of both the life raft's feasibility and reliability has been proven in an extensive test program. Author (GRA)

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

N75-16236# Advisory Group for Aerospace Research and Development, Paris (France).
PRINCIPLES OF AVIONICS COMPUTER SYSTEMS
J. N. Bloom, ed. (Commun. Res. Centre) Dec. 1974 187 p refs
(AGARD-AG-183; AGARDograph-183) Avail: NTIS HC $7.00

An introduction to fundamentals of digital computers, data acquisition and communication, logical partitioning and optimization of subsystems is given. A methodology of design is developed by philosophical discussion, detailed description of processes, and by practical examples of the application of basic principles to the problems of system and component design. The technique of specifying a requirement is discussed in detail as are the various steps required to satisfy it. For individual titles, see N75-16237 through N75-16246.

N75-16237 Politecnico di Torino (Italy). Inst. di Elletrotecnica Generale.
BASIC DIGITAL COMPUTER CONCEPTS c60
A. R. Mao *In* AGARD Principles of Avionics Computer Systems Dec. 1974 p 3-29 refs (For availability see N75-16236 07-59)

Discussed are the five functional units of a digital computer: (1) arithmetic unit; (2) memory; (3) input devices; (4) output devices; and (5) control unit. In addition to these basic units and their construction and operation, information is given on flip-flops and registers, numeric information coding in a computer, boolean algebra, building blocks, and computer software. A.L.

N75-16238 Norwegian Defence Research Establishment, Kjeller.
DATA ACQUISITION AND COMMUNICATION FUNCTION c60
Yngvar Lundh *In* AGARD Principles of Avionics Computer Systems Dec. 1974 p 30-41 refs (For availability see N75-16236 07-59)

An avionics computer, as part of a real time system either in the air or on the ground, has to communicate with the rest of the system. To communicate requires the exchange of data in one form or another. Various aspects of such data exchange are discussed along with a brief review of some typical devices which may be part of an avionics system. Some example cases are given to show how these would communicate with the computer. A.L.

N75-16239 Norwegian Defence Research Establishment, Kjeller.
OPTIMIZATION c60
Yngvar Lundh *In* AGARD Principles of Avionics Computer Systems Dec. 1974 p 42-46 (For availability see N75-16236 07-59)

An avionics computer system, as well as all other engineering jobs, requires optimization. This optimization process may be different depending on whether the systems designer or the computer designer does the job. For this discussion it was assumed that the solution was not constrained by limited choices of standard sizes, shapes and forms, or by choices made by someone else, past history or bad fortune. Some management considerations are briefly discussed. Important technical parameters such as: logic speed, computing speed, memory capacity, communication capacity, survivability, modularity, physical parameters, and programming complexity are briefly described. Some important tradeoffs which are useful to know when seeking a way out of the multitude of possible configurations which a computer based system may be given are also identified. A.L.

N75-16240 Royal Radar Establishment, Malvern (England).
SYSTEMS AND SYSTEM DESIGN: SOFTWARE DESIGN IN COMPUTER BASED SYSTEMS c61
C. S. E. Phillips *In* AGARD Principles of Avionics Computer Systems Dec. 1974 p 47-63 refs (For availability see N75-16236 07-59)

This discussion is concerned with the production of software by professional teams for computer controlled systems dedicated to some special purpose. Such systems are essentially software based, usually real time, and much more complex than they appear to the outsider. Discussed are: (1) system design methodology; (2) programs as systems; (3) functional system approach; (4) purpose of programming network diagrams; (5) data rectangles; (6) process circles; (7) simple hierarchic program network; (8) hierarchy of diagrams; (9) simulation and testing; and (10) real time computer systems. As computer systems become less of a novelty, standardization at lower levels, though restricting possibilities, offers the avionics system engineer fewer problems if use is made of existing technologies. A.L.

N75-16241 Ferranti, Ltd., Bracknell (England).
AVIONICS SYSTEM ARCHITECTURE c06
R. E. Wright *In* AGARD Principles of Avionics Computer Systems Dec. 1974 p 64-87 refs (For availability see N75-16236 07-59)

The system architect's task is to define and combine a set of hardware components to form a system whose aggregate behavior will meet the operational requirement for the system. Most avionic systems start with an operational requirement specified by a user or airframe manufacturer. During the short history of aviation there has been a growth of such operational needs which have presented problems requiring technical solutions. The avionic system derives much from the general development in system engineering, but is subject to particular operational requirements, physical environments, and physical constraints which together justify a somewhat specialized approach. Some of the problems and techniques involved are briefly described and discussed. A.L.

N75-16242 Selenia S.p.A., Rome (Italy).
DEFINING THE PROBLEM AND SPECIFYING THE REQUIREMENT c60
Silvio Boesso and Rodolfo Gamberale *In* AGARD Principles of Avionics Computer Systems Dec. 1974 p 88-118 (For availability see N75-16236 07-59)

This discussion deals with the functional requirements of computer system and aims at the definition of a methodology for deriving them from the knowledge of the tasks to be performed. The considerations presented may be applied both to determine the suitability of a certain computer architecture and to compare different computers against a given application. The treatment starts with a brief survey of typical tasks of an avionic system, from which a sample is taken to be further analyzed as an example. Computer tasks are analyzed, also with the aid of examples, in order to show how the computer requirements can be arrived at. Author

N75-16243 Smiths Industries Ltd., London (England). Aviation Div.
MONITORING AND CONTROL OF AEROSPACE VEHICLE PROPULSION c07

E. S. Eccles *In* AGARD Principles of Avionics Computer Systems Dec. 1974 p 119-142 refs (For availability see N75-16236 07-59)
Avail: NTIS

The application of digital computer systems to the design of systems for monitoring and control of the propulsion of aerospace vehicles is discussed. The general context is related to commercial operation of vehicles using airbreathing engines. This limitation permits concentration of attention on the systems problem and removes the need for any extensive discussion of powerplant characteristics. The restriction is not serious in terms of broad powerplant characteristics. The basic features of control requirements are common to all plants using chemical energy sources and combustion for energy conversion. There are strong conceptual similarities, for instance, between throttleable rocket motors and augmented (reheated) gas turbine powerplants. Time constants and thrust levels differ but the basic problems of mixture control via independent fuel and oxidant flow control and their pumping (in the general sense) remain the same. The plant control details will be less relevant to systems using hypergolic fuels and nuclear or electric propulsion. In the same way, the operational criteria will be similar for vehicles which, in themselves, are as different as the space shuttle and STOL feeder liner systems. Commercial and military operational criteria also have many analogous, if not entirely homologous, features. Similar design trade-offs are involved for both types of organizational structure and mission objectives. The discussion identifies the basic principles involved and enables read-across to other types of operation and to other avionics systems disciplines. Author

N75-16244 Advisory Group for Aerospace Research and Development, Paris (France).
MAN-MACHINE INTERFACE **c60**
E. Keonjian *In its* Principles of Avionics Computer Systems Dec. 1974 p 143-149 (For availability see N75-16236 07-59)

As the complexity of aerospace systems grows, the requirement for augmenting, expanding and simplifying crew control capabilities becomes more demanding. The man-machine interface, which essentially is a problem of exchanging data between the system and the human has become more crucial for the operation of modern aerospace systems. To cope with this problem a new class of information processing systems (aerospace computers, multiprocessors, multiplexers), control systems and displays have been developed, and the trend toward greater integration is realized. As a consequence, the degree of pilot/operator involvement with the machine has increased in scope and complexity. Some basic elements of the man-machine interface optimization process and its relations to the total avionics system design are briefly reviewed. Author

N75-16245 Advisory Group for Aerospace Research and Development, Paris (France).
NOVEL DEVICES AND TECHNIQUES **c33**
E. Keonjian *In its* Principles of Avionics Computer Systems Dec. 1974 p 150-162 refs (For availability see N75-16236 07-59)

Considerable advances have been made over the whole range of avionic devices and techniques which have been finding their way into avionics systems, making them more effective in terms of reliability and operational capability. These are coupled with simplicity and lower cost for maintenance and ownership. This process has been accelerated particularly by the rapid progress in microelectronics, with its far reaching consequences especially for future avionic computer systems. Some advanced devices and technologies still in development are reviewed, which, when matured, could further improve the effectiveness of avionic computer systems. Author

N75-16246 Plessey Co. Ltd., Ilford (England).
SPECIFYING THE REQUIREMENTS **c66**
A. L. Freedman *In* AGARD Principles of Avionics Computer Systems Dec. 1974 p 163-178 (For availability see N75-16236 07-59)

A four step procedure is described for deriving the specification of an avionics computer system as a whole. Such a specification makes it possible to decide first of all whether to go ahead with the system, and secondly if the decision is taken to go ahead, to eliminate the main sources of the troubles which have plagued these projects in the past. The procedure stems directly from the definition of a real time system as a tool to assist in performing a given activity. The activity may be the control of interceptor aircraft or the control of the systems on board an aircraft. Techniques used to design an optimum system to meet the specification are briefly covered. A.L.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

N75-16247# Illinois Univ., Urbana. Dept. of Computer Science.
DESIGN IMPROVEMENTS IN THE COLFTAR COOLED CRYSTAL LIGHT-VALUE
Stanley John Kopec, Jr. Jul. 1974 46 p refs
(PB-235885/1; UIUCDCS-R-74-669) Avail: NTIS HC $3.75 CSCL 09B

This report describes four improvements to the electronics of the COLFTAR (Cooled On-Line Fourier Transform and Reconstruction) System. These improvements are: the addition of more reliable crystal-temperature sensors, a new higher capacity write gun, synchronization of the entire system, and the addition of dynamic focusing to the write gun circuitry. These changes improve the reliability of the system and provide for improved resolution and contrast. Author (GRA)

N75-16248# Colorado Univ., Boulder. Dept. of Computer Science.
PRELIMINARY THOUGHTS ON DEGREES OF SECURITY IN MULTIPROCESSOR SYSTEMS Final Report
Clarence A. Ellis and Gary J. Nutt Jan. 1974 13 p refs
(Grant NSF GJ-660)
(PB-235292/0; CU-CS-036-74) Avail: NTIS HC $3.25 CSCL 09B

The existence of simultaneously running processes in a multiprocessor system causes certain issues in operating systems design to be critical; deadlock becomes more likely as the number of processes grows; the scheduling of processes to processors becomes less intuitive; and sharing of resources under system authorization becomes more difficult to 'guarantee'. In this paper the authors are interested in quantifying the amount of authorized and unauthorized resource sharing in a class of multiple process, multiple resource systems which employ a particular protection mechanism. Author (GRA)

N75-16237 Politecnico di Torino (Italy). Inst. di Elletrotecnica Generale.
BASIC DIGITAL COMPUTER CONCEPTS
A. R. Mao *In* AGARD Principles of Avionics Computer Systems Dec. 1974 p 3-29 refs (For availability see N75-16236 07-59)

N75-16238 Norwegian Defence Research Establishment, Kjeller.
DATA ACQUISITION AND COMMUNICATION FUNCTION
Yngvar Lundh *In* AGARD Principles of Avionics Computer Systems Dec. 1974 p 30-41 refs (For availability see N75-16236 07-59)

N75-16239 Norwegian Defence Research Establishment, Kjeller.
OPTIMIZATION
Yngvar Lundh *In* AGARD Principles of Avionics Computer Systems Dec. 1974 p 42-46 (For availability see N75-16236 07-59)

N75-16242 Selenia S.p.A., Rome (Italy).
DEFINING THE PROBLEM AND SPECIFYING THE REQUIREMENT
Silvio Boesso and Rodolfo Gamberale *In* AGARD Principles of Avionics Computer Systems Dec. 1974 p 88-118 (For availability see N75-16236 07-59)

N75-16244 Advisory Group for Aerospace Research and Development, Paris (France).
MAN-MACHINE INTERFACE
E. Keonjian *In its* Principles of Avionics Computer Systems Dec. 1974 p 143-149 (For availability see N75-16236 07-59)

N75-16264 Royal Radar Establishment, Malvern (England).
AN EXERCISE IN MULTI-PROCESSOR OPERATING-SYSTEM DESIGN
R. S. Newton *In* AGARD Real Time Computer Based Systems Dec. 1974 9 p refs (For availability see N75-16257 07-62)

N75-16268 Smiths Industries Ltd., Bishops Cleeve (England).
COMPACT INTERPRETERS: THEIR IMPLICATIONS ON SOFTWARE AND HARDWARE DESIGN
K. A. Helps *In* AGARD Real Time Computer Based Systems Dec. 1974 10 p refs (For availability see N75-16257 07-62)

N75-16272 Burroughs Corp., Paoli, Pa. Federal and Special Systems Group.
BURROUGTS AUTOMATIC COMMUNICATIONS SYSTEM THE FOURTH GENERATION (BACS IV)
Charles S. Modricker *In* AGARD Real Time Computer Based Systems Dec. 1974 10 p (For availability see N75-16257 07-62)

N75-16273 Service Technique des Telecommunications de l'Air, Paris (France).
ORGANIZATION OF STRIDA (SYSTEM FOR PROCESSING AIR DEFENSE INFORMATION) [ORGANISATION DU STRIDA (SYSTEME DE TRAITEMENT DES INFORMATIONS DE DEFENSE AERIENNE)]
D. Coulmy *In* AGARD Real Time Computer Based Systems Dec. 1974 8 p In FRENCH (For availability see N75-16257 07-62)

N75-16274 Societe d'Applications Generales d'Electricite et de Mecanique, Paris (France).
PARALLEL COMPUTER WITH AUTOMATICALLY RECONFIGURABLE ORGANIZATION (COPRA) [CALCULATEUR A ORGANISATION PARALLELE RECONFIGURABLE AUTOMATIQUEMENT (COPRA)]
M. C. Meraud and M. F. Browaeys *In* AGARD Real Time Computer Based Systems Dec. 1974 5 p In FRENCH (For availability see N75-16257 07-62)

N75-16275 Electronique Marcel Dassault, St. Cloud (France).
THE MECRA EXPERIMENTAL COMPUTER MODEL WITH AUTOMATIC RECONFIGURATION [LE MECRA MAQUETTE EXPERIMENTALE DE CALCULATEUR A RECONFIGURATION AUTOMATIQUE]
G. P. Germain *In* AGARD Real Time Computer Based Systems Dec. 1974 8 p refs In FRENCH (For availability see N75-16257 07-62)

N75-16276 AEG-Telefunken, Konstanz (West Germany).
SOME MULTICOMPUTER CONFIGURATIONS FOR RELIABILITY IN ATC SYSTEMS
J. Zuern *In* AGARD Real Time Computer Based Systems Dec. 1974 16 p refs (For availability see N75-16257 07-62)

N75-16277 Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
DISTRIBUTION OF THE TASKS IN A PHASED-ARRAY RADAR SYSTEM BETWEEN GENERAL-PURPOSE COMPUTERS AND SPECIAL PROCESSING UNITS
E. Hanle *In* AGARD Real Time Computer Based Systems Dec. 1974 7 p refs (For availability see N75-16257 07-62)

N75-16278 Intermetrics, Inc., Cambridge, Mass.
FAULT-TOLERANCE FEATURES OF AN AEROSPACE MULTIPROCESSOR
James S. Miller *In* AGARD Real Time Computer Based Systems Dec. 1974 p 9 refs (For availability see N75-16257 07-62)

N75-16279 Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
IMPLEMENTATION OF THE MICRO PROCESSOR CONCEPT
R. C. Downs *In* AGARD Real Time Computer Based Systems Dec. 1974 11 p refs (For availability see N75-16257 07-62)

N75-16280 Centre National de la Recherche Scientifique, Toulouse (France). Lab. d'Automatique et d'Analyse des Systemes.
A FAMILY OF MODULAR PROCESSORS: THE ASMODEE PROJECT [UNE FAMILLE DE PROCESSEURS MODULAIRES: LE PROJET ASMODEE]
J. C. Laprie and A. Costes *In* AGARD Real Time Computer Based Systems Dec. 1974 11 p refs In FRENCH (For availability see N75-16257 07-62)

N75-16282 California Univ., Los Angeles. Dept. of Computer Science.
THE IMPACT OF RECENTLY DEVELOPED HYBRID COMPUTING DEVICES ON REAL-TIME SIGNAL PROCESSING
Walter J. Karplus *In* AGARD Real Time Computer Based Systems Dec. 1974 10 p refs (For availability see N75-16257 07-62) (Grant NSF GK-31463)

N75-16288 Selenia S.p.A., Rome (Italy).
DATA ACQUISITION AND DISTRIBUTION IN REAL-TIME AEROSPACE SYSTEMS
S. Boesso and R. Gamberale *In* AGARD Real Time Computer Based Systems Dec. 1974 19 p refs (For availability see N75-16257 07-02)

N75-16289 Rome Air Development Center, Griffiss AFB, N.Y.
APPLICATION OF MULTI MINICOMPUTER CONFIGURATION TO INTERACTIVE GRAPHICS AND CARTOGRAPHY
William G. McLellan and B. K. Moritz (PRC Information Sci. Co.) *In* AGARD Real Time Computer Based Systems Dec. 1974 12 p (For availability see N75-16257 07-62)

N75-16290 Lear Siegler, Inc., Grand Rapids, Mich. Instrument Div.
RF SIGNAL PROCESSING VIA CONTROL OF SPECIAL PURPOSE PRE-PROCESSORS
A. Dimitriou *In* AGARD Real Time Computer Based Systems Dec. 1974 12 p (For availability see N75-16257 07-62)

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N75-16249 British Broadcasting Corp., Kingswood (England). Research Dept.
DIGITAL VIDEO: SUBJECTIVE ASSESSMENT OF AN EXPERIMENTAL WYNER-ASH ERROR CORRECTOR
P. A. Ratliff Dec. 1974 11 p refs
(BBC-RD-1974/41) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The performance of an experimental digital video error corrector is assessed and is found to provide satisfactory protection for error probabilities up to about 0.00001. A Wyner-Ash convolutional code is employed which requires a relatively small increase in the transmitted bit-rate. The error corrector is designed to correct random digit errors that occur in digital video transmission channels, and also to provide some measure of short burst-error protection. It is found to be effective with certain transmission codes which can produce multiple errors in the decoded output of the receiver when a single digit is in error in the transmission code. Author

N75-16250*# Auburn Univ., Ala. Engineering Experiments Station.
A MULTIPROCESSOR COMPUTER SIMULATION MODEL EMPLOYING A FEEDBACK SCHEDULER/ALLOCATOR FOR MEMORY SPACE AND BANDWIDTH MATCHING AND TMR PROCESSING
David B. Bradley and J. David Irwin Dec. 1974 421 p refs (Contract NAS8-26930)

(NASA-CR-120598) Avail: NTIS HC $10.50 CSCL 09B

A computer simulation model for a multiprocessor computer is developed that is useful for studying the problem of matching multiprocessor's memory space, memory bandwidth and numbers and speeds of processors with aggregate job set characteristics. The model assumes an input work load of a set of recurrent jobs. The model includes a feedback scheduler/allocator which attempts to improve system performance through higher memory bandwidth utilization by matching individual job requirements for space and bandwidth with space availability and estimates of bandwidth availability at the times of memory allocation. The simulation model includes provisions for specifying precedence relations among the jobs in a job set, and provisions for specifying precedence execution of TMR (Triple Modular Redundant and SIMPLEX (non redundant) jobs. Author

N75-16251*# Aerospace Corp., El Segundo, Calif. Data Processing Subdiv.

OPERATIONS ANALYSIS (STUDY 2.1). PROGRAM LISTING FOR THE LOVES COMPUTER CODE

Stanley T. Wray, Jr. 30 Sep. 1974 75 p

(Contract NASw-2575)

(NASA-CR-140944; ATR-74(7341)-7) Avail: NTIS HC $4.25 CSCL 09B

A listing of the LOVES computer program is presented. The program is coded partially in SIMSCRIPT and FORTRAN. This version of LOVES is compatible with both the CDC 7600 and the UNIVAC 1108 computers. The code has been compiled, loaded, and executed successfully on the EXEC 8 system for the UNIVAC 1108. Author

N75-16252# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

CONPLOT: A GENERAL PURPOSE CONTOUR PLOTTING PROGRAM

J. T. Stadter and R. O. Weiss Jun. 1974 78 p refs Sponsored by AEC

(AEC-SNS-3060-009; ANSP-M-9) Avail: NTIS HC $4.75

The CONPLOT program is very flexible, in that function values given over a nonuniform distribution of grid points within an irregular-shaped region, may be annotated and contoured according to the user's specification. Two versions of CONPLOT were developed. The first version is directed toward the general user, while the second is specifically designed to accept the results of a SAAS 3 finite element analysis. A user's guide to each version of the program is contained in separate appendices. Author (GRA)

N75-16253# Kozponti Fizikai Kutato Intezet, Budapest (Hungary). Computer Dept.

SINBAD PROGRAM PACKAGE

K. Tarnay [1974] 44 p

(KFKI-74-52) Avail: AEC Depository Libraries HC $5.25

The SINBAD program package simulates the operation of analog-to-digital converters and contains 10 programs written in ALGOL. The characteristics of the program package are discussed, and the user specification of every program is given. Author (NSA)

N75-16254# Picatinny Arsenal, Dover, N.J.

SPLIFIT: AN INTERACTIVE GRAPHICS CURVE FITTING COMPUTER PROGRAM UTILIZING SPLINE FUNCTIONS

Miriam Hearris Jan. 1974 66 p refs

(AD-787316; PA-TR-4677) Avail: NTIS CSCL 09/2

SPLIFIT is an interactive graphics program to curve fit for a maximum of 50 input points using cubic spline functions for the smoothing process. This method forces the fitted curve through the given points and has been compared to a draftsman hand fit using the mechanical spline as a tool. The method is most useful when there are very few input points to be curve fitted. Available interactive options include, among others, ADD POINTS, DELETE POINTS, RESCALE AXES, and printer HARD COPY. The cubic splines derived are available as part of the printed output. Author (GRA)

N75-16255# TRW Systems Group, Redondo Beach, Calif.

SOFTWARE RELIABILITY STUDY Interim Technical Report 16 Oct. 1973 - 15 Jun 1974

G. R. Craig, W. L. Hetrick, M. Lipow, T. A. Thayer, and J. A. Yoxtheimer Oct. 1974 109 p refs

(Contract F30602-74-C-0036; AF Proj. 5581)

(AD-787784; RADC-TR-74-250) Avail: NTIS CSCL 09/2

The study of software error types, techniques for locating them, and recommendations for improvement of reliability are discussed. Interim results from a study of errors encountered in three large software packages are presented. Data collection and analysis schemes are summarized for subject data sets; and plans for data collection on a fourth software project are outlined. Finally, a survey of present software reliability models and a summary of TRW work in this area are given. Author (GRA)

N75-16256# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

THE SECOND GENERATION INTEGRATION ROUTINE (IGC). MK5MD2 VERSION

B. B. Holland, J. A. Yingling, and M. A. Walko 21 Oct. 1974 81 p refs Revised

(Contract NOw-62-0604)

(AD-787514; APL-TG-466-Rev) Avail: NTIS CSCL 09/2

The enclosed pages represent revisions to TG 466 (Rev.) for the MK5MD2 version of the numerical integration routine used by the second generation orbit improvement program. GRA

N75-15829 Nauka Press, Moscow (USSR).

AN ALGORITHM FOR SEQUENTIAL DECODING WITH RECURRENCES

K. Sh. Zigangirov *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 43-48 refs In RUSSIAN (For availability see N75-15824 07-32)

Copyright.

N75-16240 Royal Radar Establishment, Malvern (England).

SYSTEMS AND SYSTEM DESIGN: SOFTWARE DESIGN IN COMPUTER BASED SYSTEMS

C. S. E. Phillips *In* AGARD Principles of Avionics Computer Systems Dec. 1974 p 47-63 refs (For availability see N75-16236 07-59)

N75-16258 Space and Missile Systems Organization, Los Angeles Air Force Station, Calif.

COMPUTER SOFTWARE TESTING AND CERTIFICATION

Kenneth E. Nidiffer *In* AGARD Real Time Computer Based Systems Dec. 1974 5 p refs (For availability see N75-16257 07-62)

N75-16259 Royal Radar Establishment, Malvern (England).

SYNTACTIC METHODS FOR THE PRESCRIPTION OF PROCESSES

J. T. Webb *In* AGARD Real Time Computer Based Systems Dec. 1974 11 p refs (For availability see N75-16257 07-62)

N75-16263 Marconi-Elliott Avionic Systems Ltd., Borehamwood (England).

THE CYCLIC TIME SLOT INTERFACE AND ITS INFLUENCE ON THE SOFTWARE EXECUTIVE

A. Tonkin and R. Malcolm *In* AGARD Real Time Computer Based Systems Dec. 1974 12 p (For availability see N75-16257 07-62)

N75-16266 Siemens A.G., Munich (West Germany).

A REAL-TIME PROGRAM SYSTEM FOR CONTROLLING A PHASED ARRAY RADAR

Heinz Knetsch *In* AGARD Real Time Computer Based Systems Dec. 1974 10 p (For availability see N75-16257 07-62)

N75-16267 Naval Electronics Lab. Center, San Diego, Calif.

THE CS-4 HIGH LEVEL LANGUAGE AND ITS USE IN REAL TIME SYSTEMS

Warren E. Loper and James S. Miller (Intermetrics, Inc.) *In* AGARD Real Time Computer Based Systems Dec. 1974 11 p refs (For availability see N75-16257 07-62)

N75-16269 Royal Radar Establishment, Malvern (England).

CORAL 66: THE UK NATIONAL AND MILITARY STANDARD

N. J. F. Neve *In* AGARD Real Time Computer Based Systems Dec. 1974 7 p refs (For availability see N75-16257 07-62)

N75-16270 Plessey Radar Ltd., Havant (England). Research Centre.
A LANGUAGE FOR THE SPECIFICATION OF REAL-TIME COMPUTER-BASED SYSTEMS
D. M. Balston and O. E. Morgan *In* AGARD Real Time Computer Based Systems Dec. 1974 13 p refs (For availability see N75-16257 07-62)

N75-16271 Litton Industries, Van Nuys, Calif. Data Systems Div.
FAST INTENT RECOGNITION SYSTEM (FIRST)
S. C. Schroeder and L. E. Vaughn *In* AGARD Real Time Computer Based Systems Dec. 1974 13 p (For availability see N75-16257 07-62)

N75-16285 Litton Industries, Van Nuys, Calif. Data Systems Div.
MACROS: AN INSTRUCTION CONCEPT CHANGE
A. J. Ess and C. C. Church *In* AGARD Real Time Computer Based Systems Dec. 1974 7 p refs (For availability see N75-16257 07-62)

62 COMPUTER SYSTEMS

Includes computer networks.

N75-16257# Advisory Group for Aerospace Research and Development, Paris (France).
REAL TIME COMPUTER BASED SYSTEMS
Dec. 1974 410 p refs In ENGLISH partly in FRENCH Presented at Avionics Panel Symp., Athens, 27-31 May 1974 (AGARD-CP-149) Avail: NTIS HC $10.50

Computer design and software generation for real time avionics systems are considered. For individual titles, see N75-16258 through N75-16294.

N75-16258 Space and Missile Systems Organization, Los Angeles Air Force Station, Calif.
COMPUTER SOFTWARE TESTING AND CERTIFICATION c61
Kenneth E. Nidiffer *In* AGARD Real Time Computer Based Systems Dec. 1974 5 p refs (For availability see N75-16257 07-62)

The major problems yet to be solved in the test and certification of computer software are to insure in a cost effective manner that: (1) the software has no bugs which could cause the overall system to malfunction at critical times; and (2) the software meets the functional requirements of the user. Fertile areas of further investigation include: (1) guidance on how to test and certify software for large computer systems; (2) a reevaluation of the cost and performance trade-offs associated with third party software developers, integrators and maintainers; and (3) a realignment of the R and D support to meet current test and certification needs. Author

N75-16259 Royal Radar Establishment, Malvern (England).
SYNTACTIC METHODS FOR THE PRESCRIPTION OF PROCESSES c61
J. T. Webb *In* AGARD Real Time Computer Based Systems Dec. 1974 11 p refs (For availability see N75-16257 07-62)

It is proposed that an extended version of Foster's syntax improving device be used to generate the computer useable form of a process. The reasons for the extensions and their effect on the resulting syntax analyzers are discussed and conclusions drawn as to the flexibility and use of the technique. Author

N75-16260 Advisory Group for Aerospace Research and Development, Paris (France).
REDUCED SIZE OPTIMAL CONTROL LAWS c63
P. Bernhard (IRIA, Rocquencourt) *In its* Real Time Computer Based Systems Dec. 1974 8 p refs (For availability see N75-16257 07-62)

The problem considered is that of reducing the number of state variables fed back in the optimal control of a linear plant with quadratic performance index. A classical approach is discussed, where the state variables, or their combinations, to be fed back are chosen a priori. A new approach is proposed where we look for those state variables (or combinations of) that can be ignored. The two are compared and turn out to have very different properties. It is argued that the new method is more significative, less hazardous, and far simpler to carry out. Author

N75-16261 Texas Instruments, Inc., Huntsville, Ala.
A PROCESS DESIGN SYSTEM FOR LARGE REAL TIME SYSTEMS
Roger R. Bate *In* AGARD Real Time Computer Based Systems Dec. 1974 8 p refs (For availability see N75-16257 07-62) (Contract DAHC60-72-C-0156)

A process is designed from the top down in a structured programming known as the Process Design Language (PDL). Each level of design consists of references to modules which are defined later at the next lower level of design. Undefined modules at any stage are simulated by simple models to permit execution of the system on a computer. In this way the high level logical structure is verified before expensive detailed coding at lower levels is accomplished, and modules can be tested within a realistic environment. The Process Design System (PDS) provides translator, library management, and simulator construction facilities which relieve the process designer of most of the housekeeping chores associated with configuration control of a large system under evolutionary design. Author

N75-16262 Royal Military Coll. of Science, Shrivenham (England).
REAL TIME OPERATING SYSTEMS
K. L. Hunt *In* AGARD Real Time Computer Based Systems Dec. 1974 11 p refs (For availability see N75-16257 07-62)

The development of standard approaches to the design of operating systems is explored. Two systems currently under development or in use illustrate at least a trend to a standard approach. The relevance of work of a more formal nature to the design of operating systems is discussed in the light of recent work on synchronizing sequences. Author

N75-16263 Marconi-Elliott Avionic Systems Ltd., Borehamwood (England).
THE CYCLIC TIME SLOT INTERFACE AND ITS INFLUENCE ON THE SOFTWARE EXECUTIVE c61
A. Tonkin and R. Malcolm *In* AGARD Real Time Computer Based Systems Dec. 1974 12 p (For availability see N75-16257 07-62)

The cyclic time slot interface is described which has advantages when peripherals exhibit peaky data rates. Software executives are classified and it is shown that under certain well defined conditions a scanning executive, with a cyclic time slot interface, is the optimum. A surveillance radar system is described and this is used as an illustration of an application of the interface. Author

N75-16264 Royal Radar Establishment, Malvern (England).
AN EXERCISE IN MULTI-PROCESSOR OPERATING-SYSTEM DESIGN c60
R. S. Newton *In* AGARD Real Time Computer Based Systems Dec. 1974 9 p refs (For availability see N75-16257 07-62)

Design concepts and structuring of a multiprocessor general purpose operating system are discussed, and those features of the operating system peculiar to multiprocessing are identified. Author

N75-16265 Royal Radar Establishment, Malvern (England).
MASCOT: A MODULAR APPROACH TO SYSTEM CONSTRUCTION OPERATION AND TEST
K. Jackson and H. R. Simpson (Royal Air Force, Leeming, Engl.) *In* AGARD Real Time Computer Based Systems Dec. 1974 18 p refs (For availability see N75-16257 07-62)

The MASCOT approach has formalized a method for dealing with the interconnection and intercommunication between loosely coupled programs i.e. programs which interact in a manner other than by direct call. To this end, some basic types of modules have been defined which are independent even after compilation.

These modules may be connected together to construct subsystems which interface with each other by user defined channels. This construction facility is supported by some basic software which allows software synchronization both within subsystems and between subsystems to ensure an orderly and sustained flow of data through the system. To back up the paper study, the majority of the key features have been implemented using Coral 66 on a Marconi Myriad computer.
Author

N75-16266 Siemens A.G., Munich (West Germany).
A REAL-TIME PROGRAM SYSTEM FOR CONTROLLING A PHASED ARRAY RADAR c61
Heinz Knetsch *In* AGARD Real Time Computer Based Systems Dec. 1974 10 p (For availability see N75-16257 07-62)

The software of an experimental radar system is described that is equipped with a planar phased array antenna and two linear phased array antennas. The planar antenna is used as a primary radar antenna while the two orthogonally arranged linear arrays serve as secondary radar antennas. To operate the experimental radar system it is necessary to have a software system for radar process control and evaluation of the air situation. This software system consists of a series of relatively independent process control programs whose execution is initiated by a superordinate control program under real time conditions. A priority and time slice control in the executive program ensures real time operation. The user programs are complemented by input/output programs each of which controls and supervises an individual device connected to the system. The executive program supervises all events occurring during the process and initiates the required activities.
Author

N75-16267 Naval Electronics Lab. Center, San Diego, Calif.
THE CS-4 HIGH LEVEL LANGUAGE AND ITS USE IN REAL TIME SYSTEMS c61
Warren E. Loper and James S. Miller (Intermetrics, Inc.) *In* AGARD Real Time Computer Based Systems Dec. 1974 11 p refs (For availability see N75-16257 07-62)

The All Applications Digital Computer (AADC) program is used in the development of a modular computer designed to be assembled from off-the-shelf, large scale integrated (LSI) silicon wafer and magnetic thin film building blocks. From these components can be configured a simple minicomputer, or a large multiprocessor, or anything in between. Exploitations of the architecture of machines such as the AADC require the supporting exploitations of the state-of-the-art of computer programming languages and their use in the development of reusable program modules in the construction of large systems. In an attempt to reduce the high cost of software, CS-4 is being designed to meet this requirement.
Author

N75-16268 Smiths Industries Ltd., Bishops Cleeve (England).
COMPACT INTERPRETERS: THEIR IMPLICATIONS ON SOFTWARE AND HARDWARE DESIGN c60
K. A. Helps *In* AGARD Real Time Computer Based Systems Dec. 1974 10 p refs (For availability see N75-16257 07-62)

There is a place in avionics real time systems for programs to be stored in compact code and executed by interpretation. Compact interpretable code is here used to mean code designed to require near-minimum storage. Substantially smaller storage is required for compact code than for normal code as produced by an efficient compiler or assembler. Typically the compression ratio is .5 to .7 and an overhead of a few hundred words for the interpreter is required. The penalty for this compression of code is a rise in execution time. The use of compact interpretable code is very attractive in some avionics applications on storage considerations alone, but its use has repercussions on other areas of the digital systems design, particularly in improving legibility and maintainability of software and in promoting portability. Compact interpretation is a software analogue of microprogramming.
Author

N75-16269 Royal Radar Establishment, Malvern (England).
CORAL 66: THE UK NATIONAL AND MILITARY STANDARD c61
N. J. F. Neve *In* AGARD Real Time Computer Based Systems Dec. 1974 7 p refs (For availability see N75-16257 07-62)

The evolution of CORAL 66 as a standard programming language for use in real time systems in the United Kingdom is reported, with emphasis on the managerial and executive organization necessary to launch and support the language. The organization necessary to maintain the language as a standard, and the methods adopted in practice to ensure that the standard is not debased are discussed. The benefits that have accrued from adopting a policy of language standardization are summarized.
Author

N75-16270 Plessey Radar Ltd., Havant (England). Research Centre.
A LANGUAGE FOR THE SPECIFICATION OF REAL-TIME COMPUTER-BASED SYSTEMS c61
D. M. Balston and O. E. Morgan *In* AGARD Real Time Computer Based Systems Dec. 1974 13 p refs (For availability see N75-16257 07-62)

Current methods of conveying the specification of real time computer based systems rely heavily on natural language as the medium for communication and agreement between customer and contractor. Misinterpretation and ambiguities are easily introduced if statements are made in natural language however and the cost of rectification can be high both in monetary and time terms. The initial specification is presented for a formal language which has been developed to convey system specification information. The language forces the writer to emphasize the hierarchical nature of the system and thus encourages a logical and progressive flow of information. The resulting specification serves a dual purpose as the same text can provide both an overview of the system and a detailed specification of every sub-unit.
Author

N75-16271 Litton Industries, Van Nuys, Calif. Data Systems Div.
FAST INTENT RECOGNITION SYSTEM (FIRST) c61
S. C. Schroeder and L. E. Vaughn *In* AGARD Real Time Computer Based Systems Dec. 1974 13 p (For availability see N75-16257 07-62)

The design of an APL language computer for use in command and control systems is investigated. The computer is divided into four functional units. The major innovation is the unit which determines, at execution time, the optimum execution code for array processing statements. This code is later executed by another unit specifically designed for array operand expressions. The design is currently being evaluated using an emulator written for an APL time sharing system. The evaluation shows a distinct cost/performance advantage over both a naive approach and a conventional computer system. In addition, use of this computer in an interactive command and control system or real time avionics application will greatly reduce software development and integration time and cost.
Author

N75-16272 Burroughs Corp., Paoli, Pa. Federal and Special Systems Group.
BURROUGHS AUTOMATIC COMMUNICATIONS SYSTEM THE FOURTH GENERATION (BACS IV) c60
Charles S. Modricker *In* AGARD Real Time Computer Based Systems Dec. 1974 10 p (For availability see N75-16257 07-62)

The design and development of a computer system architecture is reported for application to real time processing. The avionics multiprocessor system uses either a semiconductor memory or an integrated circuitry as a communication switch. Through the use of microprogramming, instruction sets unique to an application are created and stored in a control memory for interpretation.
G.G.

N75-16273 Service Technique des Telecommunications de l'Air, Paris (France).
ORGANIZATION OF STRIDA (SYSTEM FOR PROCESSING AIR DEFENSE INFORMATION) [ORGANISATION DU STRIDA (SYSTEME DE TRAITEMENT DES INFORMATIONS DE DEFENSE AERIENNE)] c60
D. Coulmy *In* AGARD Real Time Computer Based Systems Dec. 1974 8 p In FRENCH (For availability see N75-16257 07-62)

A real time data processing system, STRIDA, for processing air defense information is reported. The system utilizes a computer which processes data furnished by radars and presents the data

to the controller. Data are included on the types of equipment, methods of programming, and the arrangement needed to insure satisfactory availability of the system. Transl. by E.H.W.

N75-16274 Societe d'Applications Generales d'Electricite et de Mecanique, Paris (France).
PARALLEL COMPUTER WITH AUTOMATICALLY RECONFIGURABLE ORGANIZATION (COPRA) [CALCULATEUR A ORGANISATION PARALLELE RECONFIGURABLE AUTOMATIQUEMENT (COPRA)] c60
M. C. Meraud and M. F. Browaeys *In* AGARD Real Time Computer Based Systems Dec. 1974 5 p In FRENCH (For availability see N75-16257 07-62)

To meet the demand for reliability in digital computer data, a study was made to identify and solve the problems associated with such demands. The COPRA program is a structural arrangement which permits more confidence than is assessible by other technological means. Three fundamental mechanisms were utilized: a failure reconfiguration element which utilizes other equipment to share operations in case of performance degradation, an error detection element which inhibits the output of all errors in the results, and the resumption element which permits the continuation of the mission in cases after failure. Transl. by E.H.W.

N75-16275 Electronique Marcel Dassault, St. Cloud (France).
THE MECRA EXPERIMENTAL COMPUTER MODEL WITH AUTOMATIC RECONFIGURATION [LE MECRA MAQUETTE EXPERIMENTALE DE CALCULATEUR A RECONFIGURATION AUTOMATIQUE] c60
G. P. Germain *In* AGARD Real Time Computer Based Systems Dec. 1974 8 p refs In FRENCH (For availability see N75-16257 07-62)

A computer model supporting the study of diverse methods to increase reliability and security in computer operations was examined. Several types of redundancies were put to work and the gains in reliability were evaluated. Reconfiguration methods were implemented and improvements of their effectiveness were tested. Experimental conclusions and calculated reliability are included. The validity of all solutions are examined, in particular, aspects of placing the work under LSI technology. Transl. by E.H.W.

N75-16276 AEG-Telefunken, Konstanz (West Germany).
SOME MULTICOMPUTER CONFIGURATIONS FOR RELIABILITY IN ATC SYSTEMS c60
J. Zuern *In* AGARD Real Time Computer Based Systems Dec. 1974 16 p refs (For availability see N75-16257 07-62)

The experience in developing double computer systems with one computer operational and the other stand-by, showed that even for several systems with very different operational programs, the method for double computer monitoring and automatic switchover can be similar or the same for each. The method used in several applications is to have each computer send in fixed time intervals appropriate status and control information to an independent unit. Several multicomputer ATC systems are discussed in detail to illustrate the effect of various data input and output availabilities and data storage reliability requirements. The experience with these systems has shown that the reliability improvements of each type meet the high requirements of ATC. Author

N75-16277 Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
DISTRIBUTION OF THE TASKS IN A PHASED-ARRAY RADAR SYSTEM BETWEEN GENERAL-PURPOSE COMPUTERS AND SPECIAL PROCESSING UNITS c60
E. Hanle *In* AGARD Real Time Computer Based Systems Dec. 1974 7 p refs (For availability see N75-16257 07-62)

In a future radar system with an electronically steered antenna a lot of tasks must be handled simultaneously with high speed, which do not run down with fixed parameters and independently from each others like in usual radar systems. The presentation shows, that in this multi-function processing system no units of the same kind can be implemented, since at particular points in the system data volumes of very different sizes and in various time intervals occur. The steering of the different functions by data dependent parameters and the overall system control must be handled by programmable general purpose computers, since during these control functions a lot of different data must be stored for a long time. Examples for that are given in the presentation, including implementation of graceful degradation. Author

N75-16278 Intermetrics, Inc., Cambridge, Mass.
FAULT-TOLERANCE FEATURES OF AN AEROSPACE MULTIPROCESSOR c60
James S. Miller *In* AGARD Real Time Computer Based Systems Dec. 1974 p 9 refs (For availability see N75-16257 07-62)

Processor errors are detected by comparing results from duplexed units executing concurrently. Local processor storage is also duplexed, and segregated from processing units. Parity checking is used to identify the invalid copy when a comparison failure is signalled. Instruction execution is split into phases such that no phase overwrites its input. A hard-core redundant unit is used to command instruction-phase retry following a fault. If retry fails, another processor is interrupted to unload the faulty processor's local storage and prepare the disrupted process for immediate resumption at the point of failure. Recovery from faults in main memory capitalizes on the descriptor-based memory multiplexing scheme used for normal operation. A novel use of interleaving allows hardware-supported duplicated safe storage of data segments in main memory, since these change too frequently to be duplicated on secondary storage. Author

N75-16279 Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
IMPLEMENTATION OF THE MICRO PROCESSOR CONCEPT c60
R. C. Downs *In* AGARD Real Time Computer Based Systems Dec. 1974 11 p refs (For availability see N75-16257 07-62)

Because of their small size, low power consumption, high reliability, and environmental ruggedness the micro processor is entering new application fields, where previously mini processors were unacceptable. These applications include the sophistication of military and aerospace equipment, whose complex control functions are now equalled by the computing capabilities of the micro processor. The development and capabilities of the micro processor in terms of physical, hardware, and software characteristics in the implementation of the micro processor concept are discussed. Author

N75-16280 Centre National de la Recherche Scientifique, Toulouse (France). Lab. d'Automatique et d'Analyse des Systemes.
A FAMILY OF MODULAR PROCESSORS: THE ASMODEE PROJECT [UNE FAMILLE DE PROCESSEURS MODULAIRES: LE PROJET ASMODEE] c60
J. C. Laprie and A. Costes *In* AGARD Real Time Computer Based Systems Dec. 1974 11 p refs In FRENCH (For availability see N75-16257 07-62)

A communication covering the ASMODEE project, including numerical techniques, real time operation, and computer architectural concepts is presented. Objectives of the project include a study of: structure concepts of numerical control better adopted to specific needs and security functions, and decentralized structures which provide for the development of a new system of distributed hierarchy control. Transl. by E.H.W.

N75-16281* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DEVELOPMENT AND DEMONSTRATION OF HYBRID PROGRAMMABLE ATTITUDE CONTROL ELECTRONICS c63
L. S. Smith and E. H. Kopf, Jr. *In* AGARD Real Time Computer Based Systems Dec. 1974 10 p refs (For availability see N75-16257 07-62)
(Contract NAS7-100)

HYPACE provides an adaptable, analog/digital design approach that permits preflight and in-flight accommodation of mission changes, component performance variations, spacecraft changes, etc., through programing. This enabled broad multimission flexibility of application in a cost-effective manner. The HYPACE design, which was demonstrated in breadboard form on a single-axis gas-bearing spacecraft simulation, uses a single control channel to perform the attitude control functions

sequentially, thus significantly reducing the number of component parts over hard-wired designs. The success of this effort resulted in the concept being selected for the Mariner/Jupiter/Saturn 1977 spacecraft application. Author

N75-16282 California Univ., Los Angeles. Dept. of Computer Science.
THE IMPACT OF RECENTLY DEVELOPED HYBRID COMPUTING DEVICES ON REAL-TIME SIGNAL PROCESSING **c60**
Walter J. Karplus *In* AGARD Real Time Computer Based Systems Dec. 1974 10 p refs (For availability see N75-16257 07-62) (Grant NSF GK-31463)

Recent advances in the analog and hybrid computing field are reviewed, as well as implications of newly developed devices upon the design of real-time signal processing systems. The preprocessing of continuous data, using analog modules, prior to digitizing as well as the utilization of a number of parallel analog/digital converters appears to hold particular promise. Author

N75-16283 Texas Instruments, Inc., Dallas.
THE ADVANCED SCIENTIFIC COMPUTER: AN ADVANCED COMPUTER ARCHITECTURE AND ITS REAL-TIME APPLICATION TO BALLISTIC MISSILE DEFENSE **c99**
John W. Blakemore *In* AGARD Real Time Computer Based Systems Dec. 1974 12 p (For availability see N75-16257 07-62)

The advanced scientific computer (ASC) is a computer system utilizing three processing units: one optimized for control, one optimized for high speed arithmetic/logical operations on ordered arrays (called vectors) of data, and the third used exclusively for data transfers. This high throughput potential is due principally to the design of the control processor which permits continuous control operations without interferring with vector processing operations and to the fact that the ballistic missile defense problem provides vectors of data (on targets) in a natural way. The ASC control processor (through special hardware) is provided positive control over all elements of the system (i.e. memory, data channels, and the arithmetic/logical processor). It is implemented as eight independently programmable processors, each provided access to the entire memory space. The memory space may be implemented in slow or fast memory or a mixture of the two. The memory is all solid state, interleaved and overlapped, providing data to the processing elements at a maximum nominal rate of one word every six nanoseconds. Memory management, control, and protection is facilitated by the control processor special hardware. Author

N75-16284 Marconi-Elliott Avionic Systems Ltd., Rochester (England). Airport Works.
THE INFLUENCE OF AVIONIC SYSTEM REQUIREMENT ON AIRBORNE COMPUTER DESIGN **c06**
J. T. Shepherd *In* AGARD Real Time Computer Based Systems Dec. 1974 21 p (For availability see N75-16257 07-62)

Constraints imposed upon the airborne computer designer by system performance and aircraft operational economic environment are examined. System requirements include air data systems, autopilots and flight director systems, head up, weapon delivery systems, navigation systems, central management systems and engine control systems. Size and weight, environmental design, reliability and maintainability, integrity, and thermal and cooling requirements are considered as part of the operational constraints. The type of architectures that evolve from these requirements are discussed. Trade-off studies between instruction code/addressing structure and store utilization are also included. Author

N75-16285 Litton Industries, Van Nuys, Calif. Data Systems Div.
MACROS: AN INSTRUCTION CONCEPT CHANGE **c61**
A. J. Ess and C. C. Church *In* AGARD Real Time Computer Based Systems Dec. 1974 7 p refs (For availability see N75-16257 07-62)

Macro (in hardware) instructions make a change that improves storage efficiency and program execution time. Briefly, the computer evolution is described and includes statistics of computer instructions which led to the development of the Macro concept. The Macro instruction of 1-byte length (8 bits) provides multiple functions. Examples are given to demonstrate the advantages of Macros, storage savings, and improved computer throughput. Author

N75-16286 Computing Devices of Canada, Ltd., Ottawa (Ontario).
MICROPROGRAMMED COMPUTER COMBINED AVIONICS DISPLAY AND DATA PROCESSING **c06**
Dale R. Younge *In* AGARD Real Time Computer Based Systems Dec. 1974 12 p (For availability see N75-16257 07-62)

A small-size, high-performance, airborne-computer (IDP-974 General-Purpose Computer) was developed for application in an integrated display and processor system (IDPS) for lower-cost aircraft. The prime objective of this development was to optimize cost-effectiveness of the computer and primary displays subsystem by means of time-sharing the displays servicing, ballistics, navigation, etc., in a single central general-purpose computer. That is, the time-sharing of ballistics and navigation in the same computer is now commonplace, however, the additional task of real-time multiple displays servicing together with more sophisticated ballistics (the Hot-Line Air-to-Air mode) and navigation (multi-sensor mixing) required a sizeable increase in central computer performance. The availability of complex integrated circuits has made possible such increased performance in addition to decreased size and cost. The computer described herein averages more than 400,000 operations per second and occupies a 1/2 ATR volume. In addition to merely high-speed, performance was increased further by virtue of a more versatile architecture, such as a large quantity of operational registers and complex instructions, than is normally found in low-cost computers. Author

N75-16287 British Aircraft Corp. (Operating) Ltd., Bristol (England). Commercial Aircraft Div.
TRAFFIC MODELLING OF MILITARY COMMUNICATION SYSTEMS ON DIGITAL COMPUTERS **c32**
D. V. Turner *In* AGARD Real Time Computer Based Systems Dec. 1974 10 p (For availability see N75-16257 07-62)

A model developed by the author to simulate the flow of traffic around a network is described, and a military communication model is discussed in detail. Both the physical representation of the system as a data structure and the processing functions of the simulator are discussed. M.C.F.

N75-16288 Selenia S.p.A., Rome (Italy).
DATA ACQUISITION AND DISTRIBUTION IN REAL-TIME AEROSPACE SYSTEMS **c60**
S. Boesso and R. Gamberale *In* AGARD Real Time Computer Based Systems Dec. 1974 19 p refs (For availability see N75-16257 07-02)

The exchange of information is described between data sources, computing facilities and data users. Data routing and the control of digital, time-multiplexed data buses are discussed. A traffic model is presented to serve as a basis for developing a bus control algorithm. M.C.F.

N75-16289 Rome Air Development Center, Griffiss AFB, N.Y.
APPLICATION OF MULTI MINICOMPUTER CONFIGURATION TO INTERACTIVE GRAPHICS AND CARTOGRAPHY **c60**
William G. McLellan and B. K. Moritz (PRC Information Sci. Co.) *In* AGARD Real Time Computer Based Systems Dec. 1974 12 p (For availability see N75-16257 07-62)

This system is described to produce error free digital data cells containing topographic data in geographic coordinates that are completely identifiable. The large central minicomputer is equipped with printer, magnetic tape transports, and rotating memory. Current design allows for up to 10 work stations to be simultaneously operating with the single large minicomputer central processor. M.C.F.

N75-16290 Lear Siegler, Inc., Grand Rapids, Mich. Instrument Div.
RF SIGNAL PROCESSING VIA CONTROL OF SPECIAL PURPOSE PRE-PROCESSORS **c60**
A. Dimitriou *In* AGARD Real Time Computer Based Systems Dec. 1974 12 p (For availability see N75-16257 07-62)

Radio frequency signal processing for radar, ECM, acoustic,

Loran, Nav-Sat and other applications involves rapid sampling of the received signal and quick processing of the sampled data. Two approaches are possible when a digital computer is used for signal processing. One is to dedicate the computer to signal processing functions and allow other computational tasks to be performed as time permits. The other approach is to have a pre-processor or pre-processors operating under control of a central processing element. The pre-processor, in this case, performs the time consuming tasks of data sampling and simple manipulations of the sampled data. The data is then transferred to the central processor where more sophisticated processing is performed. This paper describes the control which is necessary in order for a pre-processor to operate under control of a central data processing element. Examined specifically, is the operation of a Loran-C pre-processor. Author

N75-16291 Ministry of Defence, London (England).
DEVELOPMENT EXPERIENCES OF REAL TIME COMPUTER BASED SYSTEMS IN STRIKE AIRCRAFT c06
C. J. U. Roberts *In* AGARD Real Time Computer Based Systems Dec. 1974 6 p (For availability see N75-16257 07-62)

This paper will describe the nav/attack system that is fitted to the UK version of the Jaguar aircraft with particular reference to its computing sub-system. The paper will also discuss the effect that the flexibility of digital computing has had on the flight trials program together with some of the salutary experience that has been gained on the inter-relationships of hardware and software and the need for a disciplined validation process for the flight program software. Author

N75-16292 International Business Machines Corp., Owego, N.Y.
LAMPS: A CASE HISTORY OF PROBLEMS/DESIGN OBJECTIVES FOR AN AIRBORNE DATA HANDLING SUBSYSTEM c06
Rex Reed and Howard J. Cattie, Jr. (NADC, Warminster, Pa.) *In* AGARD Real Time Computer Based Systems Dec. 1974 11 p (For availability see N75-16257 07-62)

This paper is presented to clarify and broaden the understanding of the problems relating to computer-based realtime systems. A current U.S. Navy avionics data handling subsystem aboard a destroyer-based helicopter, will be reviewed as it progressed from the concept evaluation and flight test phases of an engineering test bed to the present engineering prototype. An analysis of the test bed's positive and negative data handling features are discussed with respect to their influence on the follow-on design. The prevailing philosophies and constraints surrounding such a development impacts the design alternatives while a balancing of hardware/software parameters assists in optimizing system performance. Finally, the importance, even in the early design efforts of hardware/software cooperation is emphasized if an optimum design is to be achieved within the surrounding realities. Such early cooperation, as seen in the example, is felt to have optimized hardware design as well as eliminated much of the software required to rectify the lack of desirable, or even essential hardware features typical of independent design efforts. Author

N75-16293 IBM Italia, Rome.
DIGITAL REAL TIME SIMULATION OF FLIGHT c09
Nunzio LaFerlita *In* AGARD Real Time Computer Based Systems Dec. 1974 17 p refs (For availability see N75-16257 07-62)

The simulation of flight is discussed, producing real-time phenomenon. The problems arising from general purpose digital computers to simulate real-time flight are investigated. M.C.F.

N75-16294 Eurocontrol Agency, Maastricht (Netherlands).
THE MAASTRICHT DATA PROCESSING AND DISPLAY SYSTEM: A STEP IN AUTOMATION OF AIR TRAFFIC CONTROL (THE SOFTWARE STRUCTURE OF THE SYSTEM) c04
R. Ehrmanntraut *In* AGARD Real Time Computer Based Systems Dec. 1974 14 p (For availability see N75-16257 07-62)

The system performs multi radar tracking on data from up to 6 radar stations. Extensive checks of data entering the system, especially for flight plans, are carried out. The system performs correlation of plans and tracks. Information in the data bank is automatically updated by radar. Technical particularities concerning the degree of modularity are discussed, and data bank structure and some supervisory aspects are highlighted. It is shown that in the event of a hardware or software failure, a system reconfiguration will take place. In case the main computer fails, restart takes place from safe data on disk memory. Author

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N75-16295*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DIGITAL COMPUTER CONTROL OF A 30-cm MERCURY ION THRUSTER
C. A. Low, Jr. 1975 22 p refs Proposed for presentation at 11th Elec. Propulsion Conf., New Orleans, 19-21 Mar. 1975; sponsored by AIAA
(NASA-TM-X-71661; E-8245) Avail: NTIS HC $3.25 CSCL 09B

The major objective was to define the exact role of an onboard spacecraft computer in the control of ion thrusters. An initial computer control system with accurate high speed capability was designed, programmed, and tested with the computer as the sole control element for an operating ion thruster. The command functions and a code format for a spacecraft digital control system were established. A second computer control system was constructed to operate with these functions and format. A throttle program sequence was established and tested. A two thruster array was tested with these computer control systems and the results reported. Author

N75-16296# Technische Universitaet, Munich (West Germany).
STUDIES ON THE INFLUENCE OF THE QUANTIZATION EFFECT IN DIGITAL ANGULAR STEP CONTROL Ph.D. Thesis [UNTERSUCHUNG DE AUSWIRKUNG DES QUANTISIERUNGSEFFEKTES BEI EINER STETIGAEHNLICHEN DIGITALEN WINKLEREGELUNG]
Erwin Eder 31 Jul. 1974 152 p refs In GERMAN
Avail: NTIS HC $6.25

Electronic control of industrial machine drives insures optimal velocity relations between the work piece and continuing support gear. Stationary contact optimization is provided by a superimposed digital angular servocontrol loop that contains a quartz oscillator for reference pulse frequency regulation by digital integrator. Transl. by G.G.

N75-16297# Illinois Univ., Urbana. Coordinated Science Lab.
CONTROL OF MIXED DISTRIBUTED AND LUMPED PARAMETER SYSTEMS
Arild Thowsen Aug. 1974 119 p refs
(Contract DAAB07-72-C-0259; Grant AF-AFOSR-2570-73)
(AD-787730; R-661; UILU-ENG-74-2227) Avail: NTIS CSCL 12/1

Optimal control, observability, and controllability of linear systems governed by simultaneous sets of ordinary and partial differential equations are investigated. Such systems are called mixed distributed and lumped parameter systems. The interaction on the spatial boundary between the lumped and the distributed subsystems provides a convenient criterion for their classification. Three common types of mixed distributed and lumped parameter systems are identified and practical examples are referenced. Optimal sampled-data control of mixed systems is studied. (Modified author abstract) GRA

N75-16260 Advisory Group for Aerospace Research and Development, Paris (France).
REDUCED SIZE OPTIMAL CONTROL LAWS
P. Bernhard (IRIA, Rocquencourt) *In its* Real Time Computer Based Systems Dec. 1974 6 p refs (For availability see N75-16257 07-62)

N75-16281* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DEVELOPMENT AND DEMONSTRATION OF HYBRID PROGRAMMABLE ATTITUDE CONTROL ELECTRONICS
L. S. Smith and E. H. Kopf, Jr. *In* AGARD Real Time Computer Based Systems Dec. 1974 10 p refs (For availability see N75-16257 07-62)
(Contract NAS7-100)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N75-16298 Polish Academy of Sciences, Warsaw.
INVARIANTS IN THE COURSE OF THE F SUB O PARAMETER [NWARIANTY W PRZEBIEGACH PARAMETRU F SUB O]
W. Jassem and K. Kudela-Dobrogowska 5 May 1973 35 p refs In POLISH
(Rept-25/1973) Avail: Issuing Activity

Automatic speech recognition in man-machine systems was investigated for extracting invariants in a range of segmented and suprasegmented acoustic features of speech signals. It is shown that the F sub O parameter, which represents the time variable is related to acoustic suprasegmental features and is a carrier of linguistic and paralinguistic information.

Transl. by M.J.S.

N75-16299# Wisconsin Univ., Madison. Mathematics Research Center.
ON CONVECTED RATES
S. L. Passman Aug. 1974 20 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-787731; MCR-TSR-1443) Avail: NTIS CSCL 20/11

The convected time rate of a general second-order tensor is recognized as a useful concept in continuum mechanics. It is shown that a recursion formula for convected rates may be treated as a first-order differential equation and solved yielding a convection-diffusion theorem. Frame-indifference is discussed. Applications to Rivlin-Ericksen tensors, generalized convection and diffusion, stretching and spin, and convected stress rates are given. Author (GRA)

N75-16300# Wisconsin Univ., Madison. Dept. of Mathematics.
A SURVEY OF BIFURCATION THEORY
P. H. Rabinowitz Sep. 1974 24 p refs
(Contract N00014-67-A-0128-0024)
(AD-787022) Avail: NTIS CSCL 12/1

A survey of bifurcation theory is presented. Beginning by mentioning some of the phenomena in fluid dynamics and elasticity theory which led to the development of the subject, it goes on to describe the main results obtained by analytic methods (including some stability results) as well as by the application of topological and variational methods. Author (GRA)

N75-16301# Stanford Univ., Calif. Dept. of Applied Mechanics.
QUADRATIC EIGENPROBLEMS
Dean Lee Taylor and Thomas R. Kane Aug. 1974 50 p refs
(Contract N00014-67-A-0112-0065; NR Proj. 064-525)
(AD-787037; SUDAM-74-8) Avail: NTIS CSCL 12/1

This paper contains a theory for the study, in analytical terms, of the eigensystem of a multiparameter quadratic eigenproblem. Previous work in this general area has focused mainly on first order eigenproblems. In the present work, eigenvalues and eigenvectors are expressed in the form of infinite series in which parameters entering the elements of various matrices play the roles of independent variables, and it is shown how the coefficients may be evaluated. The methods of derivation are given in sufficient detail to allow extension to either higher derivatives or higher order eigenproblems. Among the results presented are formulae for the second derivatives of eigenvectors, which have not been presented previously. Formulae applicable to special cases of first order eigenproblems are given also. To illustrate the use of the theory, the behavior of a two degree of freedom gyroscopic system is considered in detail. Specifically, the effect of velocity dependent forces upon the stability of certain motions is studied. Author (GRA)

N75-15830 Nauka Press, Moscow (USSR).
COMPUTATION OF VALUES AND ROOTS OF POLYNOMIALS ABOVE A FINITE FIELD
V. B. Afanasyev *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 49-55 refs In RUSSIAN (For availability see N75-15824 07-32)
Copyright.

N75-15831 Nauka Press, Moscow (USSR).
IMPROVING THE ERROR PROBABILITY EXPONENT IN A SYSTEM WITH FEEDBACK DURING THE USE OF A CASCADE CODE
V. V. Zyablov and L. F. Zhigulin *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 56-62 refs In RUSSIAN (For availability see N75-15824 07-32)
Copyright.

N75-15842 Nauka Press, Moscow (USSR).
USING MATRIX PRODUCTIVE FUNCTIONS FOR THE ANALYSIS OF TRANSMISSION ACCURACY IN A COMMUNICATION SYSTEM
V. Ya. Turin *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 144-154 refs In RUSSIAN (For availability see N75-15824 07-32)
Copyright.

N75-15843 Nauka Press, Moscow (USSR).
DISTRIBUTION OF EXPERIMENTAL PACKAGE LENGTHS FOR MODELS BASED ON THE MARKOV CHAINS
E. L. Blokh, E. M. Bakhar, and V. Ya. Turin *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 155-163 refs In RUSSIAN (For availability see N75-15824 07-32)
Copyright.

N75-15844 Nauka Press, Moscow (USSR).
DISTRIBUTION OF EXPERIMENTAL PACKAGE LENGTHS FOR ERROR SEQUENCE FORMING A PROCESS WITH FINITE REDUCTION TIME
E. M. Bakhar *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 164-170 refs In RUSSIAN (For availability see N75-15824 07-32)
Copyright.

N75-15845 Nauka Press, Moscow (USSR).
CONSTRUCTING A MARKOV MODEL OF A DISCRETE SYMMETRIC CHANNEL ACCORDING TO EXPERIMENTAL DATA
O. V. Popov *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 171-178 refs In RUSSIAN (For availability see N75-15824 07-32)
Copyright.

N75-15850 Nauka Press, Moscow (USSR).
SOME METHODS OF GENERATING MARKOV SEQUENCES
A. G. Leontyev, A. M. Morozov, and D. M. Sudakov *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 202-210 refs In RUSSIAN (For availability see N75-15824 07-32)
Copyright.

N75-15851 Nauka Press, Moscow (USSR).
SELECTING A METHOD FOR PRODUCING N-DISCHARGING RANDOM NUMBERS
A. G. Leontyev *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 211-217 refs In RUSSIAN (For availability see N75-15824 07-32)
Copyright.

N75-15852 Nauka Press, Moscow (USSR).
A METHOD FOR PRODUCING PSEUDORANDOM NUMBERS ON A COMPUTER
I. B. Petrovskiy *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 218-220 refs In RUSSIAN (For availability see N75-15824 07-32)
Copyright.

N75-15853 Nauka Press, Moscow (USSR).
CONDITIONS DURING WHICH A MARKOV FUNCTION BECOMES A MARKOV CHAIN
V. Ya. Turin *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 221-234 refs In RUSSIAN (For availability see N75-15824 07-32)
Copyright.

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N75-16302# Naval Weapons Center, China Lake, Calif.
DISCRETE SEARCH ON THE CIRCLE
Edward A. Fay Sep. 1974 22 p
(AD-787503; NWC-TP-5691) Avail: NTIS CSCL 12/2

A finite number N of locations are equally spaced around the circumference of a circle. During each time interval of unit length a target and a searcher move simultaneously and independently among these locations. Each is allowed to move one unit counterclockwise, to stay where he is, or to move one unit clockwise. The motion of each is governed by a triple of probabilities invariant with respect to time. Between moves the searcher attempts to detect whether the target occupies the same location he does, with a constant detection probability and with false alarm probability zero. Given the triple governing the target's motion, the problem investigated is to determine the searcher's triple so as to minimize the expected length of time until detection. GRA

N75-15840 Nauka Press, Moscow (USSR).
BOUNDARIES OF THE PROBABILITY CHARACTERISTICS OF A DISCRETE SYMMETRIC CHANNEL WHOSE POSITIONS FORM A STATIONARY MARKOV CHAIN
O. V. Popov *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 130-138 ref In RUSSIAN (For availability see N75-15824 07-32)
Copyright.

N75-15841 Nauka Press, Moscow (USSR).
UPPER AND LOWER BOUNDARIES OF THE PROBABILITY CHARACTERISTICS OF A DISCRETE CHANNEL WHICH CONFORMS TO THE MARKOV CASCADE MODEL
O. V. Popov *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 139-143 refs In RUSSIAN (For availability see N75-15824 07-32)
Copyright.

N75-15849 Nauka Press, Moscow (USSR).
PRODUCING RANDOM PROCESSES WITH ASSIGNED STATISTICAL CHARACTERISTICS
Yu. N. Kalashnikov and A. G. Leontyev *In its* Increasing the Accuracy of Transmission of Digital Inform. on Discrete Channels 1974 p 195-201 refs In RUSSIAN (For availability see N75-15824 07-32)
Copyright.

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N75-16303*# Utah State Univ., Logan.
APPLICATION OF THE COMPARISON PRINCIPLE TO ANALYSIS OF NONLINEAR SYSTEMS Final Report
R. W. Gunderson 16 Jan. 1975 49 p refs
(Grant NGR-45-002-016)
(NASA-CR-142073) Avail: NTIS HC $3.75 CSCL 12A

A comparison principle based on a Kamke theorem and Lipschitz conditions is presented along with its possible applications and modifications. It is shown that the comparison lemma can be used in the study of such areas as classical stability theory, higher order trajectory derivatives, Liapunov functions, boundary value problems, approximate dynamic systems, linear and nonlinear systems, and bifurcation analysis. M.J.S.

N75-16304# Army Missile Command, Redstone Arsenal, Ala. Systems Engineering Directorate.
ITERATIVE SIMULATION OF A COMPENSATED INERTIAL PLANT
Charles A. Halijak 22 Aug. 1974 15 p refs
(AD-787280; RC-75-1) Avail: NTIS CSCL 09/5

A class of compensated inertial plant transfer functions is constructed. An iterative operational amplifier realization of these transfer functions is obtained after a study of characteristic impedances in a simulation context. Finally, any inertial control system is modeled by a single operational amplifier.
Author (GRA)

N75-16246 Plessey Co. Ltd., Ilford (England).
SPECIFYING THE REQUIREMENTS
A. L. Freedman *In* AGARD Principles of Avionics Computer Systems Dec. 1974 p 163-178 (For availability see N75-16236 07-59)

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N75-16305# Technische Universitaet, Hanover (West Germany).
BITOPOLOGICAL SPACES AND SIMPLE EXTENSIONS Ph.D. Thesis [BITOPOLOGISCHE RAEUME UND EINFACHE BEREICHERUNGEN]
Arno Warzel 19 Jun. 1974 82 p refs In GERMAN
Avail: NTIS HC $4.75

The theory of simple topological space extension is elaborated and used to find solutions for bitopological space problems.
Transl. by G.G.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N75-16306 Polish Academy of Sciences, Warsaw.
UNIFORM ASYMPTOTIC SOLUTION FOR DIFFRACTION OF AN ELECTROMAGNETIC PLANE WAVE [JEDNOLITE ROZWIAZANIE ASYMPTOTYCZNE DLA DYFRAKCJI ELEKTROMAGNETYCZNEJ FALI PLASKIEJ]
Stanislaw Przezdziecki 3 Apr. 1973 42 p refs In POLISH
(Rept-20/1973) Avail: Issuing Activity

Asymptotic solutions were developed for a conductive, infinitely thin screen on the surface of a transverse, uniaxially anisotropic media. Other topics discussed include isotropic media, Maxwell equations, Hertz electric potential, electromagnetic fields, and Helmholtz equations. Transl. by M.J.S.

N75-16307*# National Aeronautics and Space Administration. Pasadena Office, Calif.
METHOD AND APPARATUS FOR GENERATING COHERENT RADIATION IN THE ULTRAVIOLET REGION AND ABOVE BY USE OF DISTRIBUTED FEEDBACK Patent Application
Melvin M. Saffren, inventor (to NASA) (JPL) Filed 17 Dec. 1974 19 p
(Contract NAS7-100)
(NASA-Case-NPO-13346-1; US-Patent-Appl-SN-533556) Avail: NTIS HC $3.25 CSCL 20N

Helium in the superfluid state was found to emit copious amounts of radiation in the ultraviolet region when excited by an electron stream. Conventional laser action using mirrors is impossible in superfluid helium because there are no mirrors that will reflect VUV radiation. By utilizing the method of distributed feedback, the superfluid helium can be made to lase. The photons leave the superfluid helium at right angles to the

standing wave as coherent radiation having a very high intensity. The standing wave established in the superfluid helium may be an acoustical standing wave, a thermal standing wave (second sound), or an electric standing wave. NASA

N75-16308*# Toronto Univ. (Ontario). Dept. of Geology.
SURFACE ELECTRICAL PROPERTIES EXPERIMENT, PART 3 Final Technical Report
Sep. 1974 576 p refs Prepared for MIT 3 Vol.
(Contract NAS9-11540)
(NASA-CR-141473) Avail: NTIS HC $13.25 CSCL 20N

A complete unified discussion of the electromagnetic response of a plane stratified structure is reported. A detailed and comprehensive analysis of the theoretical parts of the electromagnetic is given. The numerical problem of computing numbers of the electromagnetic field strengths is discussed. It is shown that the analysis of the conductive media is not very far removed from the theoretical analysis and the numerical difficulties are not as accute as for the low-loss problem. For Vol. 1, see N75-15570; for Vol. 2 see N75-15571. M.C.F.

N75-16309# Defence Research Establishment Valcartier (Quebec).
A SEMI-EMPIRICAL CLOSURE THEORY OF OPTICAL AND IR WAVE PROPAGATION IN TURBULENT MEDIA
L. R. Bissonnette Sep. 1974 39 p refs
(DREV-R-708/74) Avail: NTIS HC $3.75

An approach to the problem of optical and IR wave propagation in turbulent media is presented. A set of differential equations is derived for the first and second order statistical moments of the fluctuation wave amplitude. These equations are written in a format from which the important mechanisms contributing to light scintillation are clearly identified to specific mathematical terms, as for instance the production of turbulent irradiance from coherent irradiance. A closure model is proposed in the form of four semi-empirical constitutive relations. Simplified solutions are obtained for an originally Gaussian beam and are compared, with known features of light scintillation. Significant results are the definitions of a turbulence interaction scaling length and similarity parameters that respectively weight the diffraction and the finite-beam effects. Author

N75-16310# National Science Foundation, Washington, D.C.
GUIDE TO PROGRAMS, FISCAL YEAR 1975
1975 91 p
Avail: SOD HC $1.70

The criteria for selection of research projects by the NSF are discussed along with the NSF relationship to other research organizations. The support is described for scientific research projects, research applications, national research centers, and international cooperative scientific activities. The objectives of the science education program are discussed. F.O.S.

N75-16311# Colorado Univ., Boulder.
LARGE AMPLITUDE STATIONARY PERIODIC TRANSVERSE WAVES
R. L. Berger Jul. 1974 24 p refs
(Contract AT(11-1)-2081)
(COO-2081-16) Avail: NTIS HC $3.25

The equilibrium and resistance of transverse magnetic Bernstein-Greene-Kruskal waves to small amplitude perturbations was studied within the framework of the Vlasov-Maxwell equations. An external magnetic field is included and spatial variations in equilibrium and perturbed quantities are taken to be in the z direction. The equilibrium state about which the Vlasov-Maxwell equations are linearized supports a spatially-periodic finite-amplitude transverse electromagnetic wave. It is found that stability depends on the complex roots of a matrix dispersion equation which relates the oscillation frequency and wavenumber of the perturbation. Explicit examples of self-consistent equilibria are constructed. The wave equation for stationary transverse waves is considered and a general condition for self-consistent solutions is derived which states that distribution functions, which are everywhere isotropic in velocity space, cannot support periodic transverse waves. Author (NSA)

N75-16312# Naval Research Lab., Washington, D.C.
THE FREQUENCY DEPENDENCE OF TROPOSPHERIC SCATTER PROPAGATION AND ITS RELATION TO STRATIFIED TURBULENCE Final Report
Merrill I. Skolnik Aug. 1974 36 p refs
(NRL Proj. R02-59; RF12151402)
(AD-787622; NRL-MR-2882) Avail: NTIS CSCL 20/14

The experimentally determined wavelength and scattering-angle dependence of tropospheric scatter propagation can be explained by applying the energy spectrum obtained from stratified turbulence theory rather than spectrum from homogeneous turbulence theory as is usually assumed. This results in the scattering to be proportional to the wavelength and to (sin theta/2) to the minus 5 power, where theta is the scattering angle. Author (GRA)

N75-16313# Science Applications, Inc., La Jolla, Calif.
A STUDY OF INSULATOR BREAKDOWN UNDER NAVY ANTENNA HV RF CONDITIONS Final Report, Jun. - Dec. 1973
C. N. Richard Mar. 1974 24 p refs
(Contract N62399-73-C-0033; YF53534011)
(AD-787067; SAI-73-631-LJ; CEL-CR-75-001) Avail: NTIS CSCL 20/14

Conditions leading to initiation of corona streamers and breakdown in gases are reviewed. The effect of electric field strength at electrode surfaces and the pressure of the gas in the electrode gap on the acceleration of free electrons with the ions and molecules in the gas are identified. The presence of water drops or contaminants can reduce corona onset field from about 30 KV/cm to about 6 KV/cm, can affect the voltage distribution, and can cause heating in strong VLF fields. GRA

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N75-16314*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE NOISINESS OF LOW FREQUENCY BANDS OF NOISE
Ben William Lawton Feb. 1975 17 p refs Presented at 88th Meeting of the Acoustical Soc. of Am., St. Louis, 4-8 Nov. 1974
(NASA-TM-X-72649) Avail: NTIS HC $3.25 CSCL 20A

The relative noisiness of low frequency 1/3-octave bands of noise was examined. The frequency range investigated was bounded by the bands centered at 25 and 200 Hz, with intensities ranging from 50 to 95 db (SPL). Thirty-two subjects used a method of adjustment technique, producing comparison band intensities as noisy as 100 and 200 Hz standard bands at 60 and 72 db. The work resulted in contours of equal noisiness for 1/3-octave bands, ranging in intensity from approximately 58 to 86 db (SPL). These contours were compared with the standard equal noisiness contours; in the region of overlap, between 50 and 200 Hz, the agreement was good. Author

N75-16315*# Aerophysics Research Corp., Hampton, Va.
PREDICTION OF SONIC BOOM FROM EXPERIMENTAL NEAR-FIELD OVERPRESSURE DATA. VOLUME 1: METHOD AND RESULTS Final Report
C. R. Glatt, D. S. Hague, and S. J. Reiners Washington NASA Feb. 1975 78 p refs
(Contract NAS1-12579)
(NASA-CR-2441) Avail: NTIS HC $4.75 CSCL 20A

A computerized procedure for predicting sonic boom from experimental near-field overpressure data has been developed. The procedure extrapolates near-field pressure signatures for a specified flight condition to the ground by the Thomas method. Near-field pressure signatures are interpolated from a data base of experimental pressure signatures. The program is an independently operated ODIN (Optimal Design Integration) program which obtains flight path information from other ODIN programs or from input. Author

N75-16316# Technische Universitaet, Munich (West Germany).
EXTRACTION AND MEASUREMENT OF INDICES IN TIMBRE CUE PERCEPTION OF STATIONARY SOUND [EXTRAKTION UND MESSUNG VON MERKMALEN DER KLANGFARBENWAHRNEHMUNG STATIONAERER SCHALLE]
Gottfried V. Bismarck 26 Jan. 1972 117 p refs In GERMAN
Avail: NTIS HC $5.25

The quantitative relationships between recognition of timbre and signal parameters is described by a functional scheme based on the acoustic-produced tonal brightness distribution.
Transl. by G.G.

N75-16317# Naval Coastal Systems Lab., Panama City, Fla.
A SOLID LENS COLLIMATOR FOR HIGH FREQUENCY NEAR-FIELD MEASUREMENTS
D. L. Folds Sep. 1974 24 p
(ZF61112001)
(AD-787433; NCSL-218-74) Avail: NTIS CSCL 20/1

A solid lens is reported that operates as the acoustic equivalent of an optical collimator to produce planar waves. The acoustic collimator uses a single transducer element placed at the focal point of an acoustic lens. Amplitude shading can be accomplished by proper selection of the attenuation coefficient of the lens material. The report describes collimator lens design considerations and experimental results obtained with a 50 cm diameter polystyrene lens used as a collimator in calibrating a 20 cm square hydrophone in the frequency range 200 to 600 kHz and a 10-cm piston in the frequency range 600 to 1200 kHz. Far-field results and those obtained with the collimator lens in the near-field are compared. (Modified author abstract) (GRA)

N75-16318# Sandia Labs., Albuquerque, N.Mex. Applied Mechanics Div.
LOW FREQUENCY RESPONSE OF A SUBMERGED CYLINDRICAL SHELL CONTAINING A FLUID
Robert C. Reuter, Jr. Aug. 1974 47 p refs Sponsored in part by DARPA
(Contract AT(29-1)-789)
(AD-787737; SAND-74-0126) Avail: NTIS CSCL 20A

Governing equations for an infinitely long, periodically supported, cylindrical shell containing a fluid and submerged in an unbounded region of another fluid are solved directly by means of Fourier harmonic expansions. Steady state, harmonic excitation for the fluid-structure system is provided along a cylindrical boundary of the internal fluid. An expression for the power radiated into the external fluid by the membrane is derived. A long wavelength approximation for radiated power is made which conditionally validates the solution for finite length shells.
Author (GRA)

N75-16319# Naval Research Lab., Washington, D.C.
ATMOSPHERIC RAY TRACING Final Report
B. G. Roberts, Jr. and E. H. Bebbs Aug. 1974 122 p refs
(NRL Proj. 81S01-36; RF52552402)
(AD-787063; NRL-MR-2865) Avail: NTIS CSCL 20/1

A computer program has been written in FORTRAN to predict the acoustical ray paths in the atmosphere, as well as determining the transmission loss in air. The program accepts data in the form of a temperature or sound speed versus height profile. A wind velocity profile may also be entered. The program will produce a printplot of the ray trajectories, as well as a printplot of the transmission loss vs range. A CALCOMP plot of the ray trajectories may also be obtained. Author (GRA)

N75-16320# Naval Postgraduate School, Monterey, Calif.
AUTOMATIC FREQUENCY TRACKING AND AN APPLICATION OF TARGET FIXING USING PASSIVE DOPPLER TECHNIQUES M.S. Thesis
Dennis Wayne Hurst Sep. 1974 117 p refs
(AD-787448) Avail: NTIS CSCL 17/1

A software package was developed to provide the inputs for a passive single-sensor acoustic tracker. This required a computation of sound propagation velocity and resolving high-resolution frequency information from raw acoustic data. A selected frequency was then automatically tracked from an up-Doppler to a down-Doppler condition. This frequency information coupled with associated bearing information was then used to provide continuous target fixes. Author (GRA)

N75-16321# Texas Univ., Austin. Applied Research Labs.
THE PROPAGATION OF A SPHERICAL N WAVE IN AN ABSORBING MEDIUM AND ITS DIFFRACTION BY A CIRCULAR APERTURE Interim Report
Mark D. Anderson Aug. 1974 109 p refs
(Contract F44620-71-C-0015; AF Proj. 9781)
(AD-787878; ARL-TR-74-25; AFOSR-74-1736TR) Avail: NTIS CSCL 20/1

The report investigates the effects of finite amplitude on the diffraction of a spherical N wave by a circular aperture. The investigation was to be carried out in the farfield of the aperture, i.e., where the incident and diffracted signals were not completely resolved. An experiment was done in which an N wave was produced by an electric spark. A condenser microphone received the acoustic signal, and an aperture in a rigid baffle was placed between the spark and the microphone. The preliminary investigations revealed that, in the farfield, absorptions as well as nonlinear distortion is important. A computer algorithm was developed in which the effects of nonlinear distortion and absorption are combined in a stepwise manner. To test the algorithm, it was used to predict the waveform of a propagating N wave. The predicted waveforms agree very favorably with experiment. (Modified author abstract) GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N75-16322*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
VIBRATION-TRANSLATION ENERGY TRANSFER IN ANHARMONIC DIATOMIC MOLECULES. 1: A CRITICAL EVALUATION OF THE SEMICLASSICAL APPROXIMATION
Robert L. McKenzie Nov. 1974 30 p refs
(NASA-TM-X-62406) Avail: NTIS HC $3.75 CSCL 20H

The semiclassical approximation is applied to anharmonic diatomic oscillators in excited initial states. Multistate numerical solutions giving the vibrational transition probabilities for collinear collisions with an inert atom are compared with equivalent, exact quantum-mechanical calculations. Several symmetrization methods are shown to correlate accurately the predictions of both theories for all initial states, transitions, and molecular types tested, but only if coupling of the oscillator motion and the classical trajectory of the incident particle is considered. In anharmonic heteronuclear molecules, the customary semiclassical method of computing the classical trajectory independently leads to transition probabilities with anomalous low-energy resonances. Proper accounting of the effects of oscillator compression and recoil on the incident particle trajectory removes the anomalies and restores the applicability of the semiclassical approximation.
Author

N75-16323# Universite Scientifique et Medicale de Grenoble (France).
DEVELOPMENT MECHANISM AND ENERGY DISSIPATION CORRESPONDING TO THE DESTRUCTION OF SINGULAR CHARGE IN THE CASE OF CONICAL CONVERGENCE Ph.D. Thesis [SUR LE MECANISME D'APPARITION ET DE DISSIPATION D'ENERGIE CORRESPONDANT AUX PERTES DE CHARGE SINGULIERES CAS DES CONVERGENTS CONIQUES]
Fritz Clermont 16 Nov. 1972 120 p refs In FRENCH
Avail: NTIS HC $5.25

Experimental methods and equipment used to study charge loss with conical convergence are examined. Special attention was given to charge loss in relation to the dynamic characteristics of geometrical outflow in the case of conical convergence. An emperical formula was suggested to study the problem. Transl. by E.H.W.

N75-16324# Chalmers Univ. of Technology, Goteborg (Sweden).
RESEARCH ACTIVITY, 1973
1973 80 p refs
(NP-20123) Avail: AEC Depository Libraries HC $7.00

Research at Chalmers Technical University and Gothenberg University is reported in a series of one-page summaries with references. Work in the following areas is included: Nuclear structure, atomic structure, electron structure of solids, ion physics, transport properties and structure of condensed matter, and metal physics and crystal studies. NSA

N75-16325# Columbia Univ., New York.
GAS-PHASE OXIDATION OF ALUMINUM ATOMS Final Report
1974 11 p refs
(Contract DA-ARO(D)-31-124-73-G82; ARPA Order 1482)
(AD-787139) Avail: NTIS CSCL 07/4

Using a beam-gas arrangement, the reaction Al O2 to AlO + O was investigated by the method of laser-induced fluorescence. The reactions of TMA (trimethyl aluminum) and TEA (triethyl aluminum) with O3 were studied at low pressure. GRA

N75-16326# Richmond Coll., Staten Island, N.Y.
RADIATION EFFECTS IN CROSSLINKING IN POLYMERIC SYSTEMS Final Report, 1 Oct. 1968 - 31 Jul. 1974
George Odian 24 Sep. 1974 8 p
(Grant DA-ARO(D)-31-124-G1063)
(AD-787531; AROD-7923-1-C; Rept-10) Avail: NTIS CSCL 07/5

The paper outlines research findings on a project involving the elucidation of the process of radiation-induced graft polymerization of monomer to polymer. The quantitative interrelationships of the initiation rate, the k(p)/(k(-) to the 1/2 power) ratio for the monomer, the equilibrium solubility of the monomer in the polymer, the polymer film thickness, the reaction time, and the diffusivity of the monomer in the polymer were investigated. Work on the project has given a mathematical analysis of the grafting reaction and its exact dependence on these factors. Equations show quantitatively how the various parameters in any grafting system interact to lead to diffusion-controlled graft polymerization. GRA

N75-16327# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NONLINEAR NARROW RESONANCES OF THE DENSITY OF EXCITED MOLECULES IN A STANDING-LIGHT WAVE
V. S. Letokhov and B. D. Pavlik 18 Sep. 1974 32 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Otd. Obshch. Fiz. Astron. (USSR), no. 8, 1972 p 1-34
(AD-787404; FTD-MT-24-1844-74) Avail: NTIS CSCL 07/4

The possibility of the resonant variation in the total number of particles on the excitation level with the transmission of the field frequency through the center of a Doppler-widened absorption line is examined. The article examines the effect of the formation of the resonance of the total number of particles in the simplest mode of the moving two-layer particles with a varied degree of saturation of absorption, and also the effect of rotational relaxation on the value of the resonance in the case of molecular transitions. GRA

N75-16328# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ALPHA RAYS IN HARNESS
N. Ilinskaya 19 Sep. 1974 7 p Transl. into ENGLISH from Sots. Industr. (USSR), no. 216, 1973 p 1
(AD-787405; FTD-HC-23-2651-74) Avail: NTIS CSCL 07/5

The report briefly mentions the use of alpha irradiation from polonium-210 to enhance combustion processes. GRA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N75-16329# Technische Universitaet, Munich (West Germany).
WEAKLY BOUND CHARGE CARRIERS AS PHONON DETECTORS FOR LOW TEMPERATURE STUDIES ON PHONONS PRODUCED BY ALPHA BEAMS, ATOMIC BEAMS, OR THERMAL SHOCK Ph.D. Thesis [TIEFTEMPERATURUNTERSUCHUNGEN AN PHONONEN, DIE DURCH PHOTONSTRAHLEN, ATOMSTRAHLEN ODER THERMOSTOSS ERZEUGT WERDEN, MIT SCHWACH GEBUNDENEN LADUNGSTRAEGERN ALS PHONONENDETEKTOREN]
Rolf Wengert 18 Sep. 1974 140 p refs In GERMAN
Avail: NTIS HC $5.75

The release of weakly bonded charge carriers in single crystals by infrared absorption is studied by observing their subsequent retrapping under phonon emission. A comparison of phonon flux production by alpha particle bombardment or with rare gas atomic- or thermal-shock shows that alpha radiation pulses remove deep traps that require a three phonon effect. Transl. by G.G.

N75-16330# Zentralstelle fuer Atomkernenergie-Dokumentation, Leopoldshafen (West Germany).
BIBLIOGRAPHIES IN NUCLEAR SCIENCE AND TECHNOLOGY. SECTION 22: NUCLEAR SHIP PROPULSION, NUMBER 14
J. C. Roemer, Comp. Apr. 1974 47 p refs In GERMAN and ENGLISH
(AED-C-22-14(1974)) Avail: AEC Depository Libraries HC $5.50

Citations from conferences, patents, reports, periodicals, and books are listed. Author and subject files are also provided. NSA

N75-16331# Eidgenoessiches Institut fuer Reaktorforschung, Wurenlingen (Switzerland).
[ORGANIZATION OF SWISS INSTITUTE FOR REACTOR RESEARCH AND ITS PRIMARY OBJECTIVES] Annual Report, 1973
30 Apr. 1974 74 p refs In GERMAN
(NP-20064) Avail: AEC Depository Libraries HC $6.75

The organization of the EIR and its primary objectives are briefly outlined. The studies made in the areas of reactor development, teaching, chemistry, electronics, hot cells, isotope production, metallurgy, and physics are indicated. A list of publications and patents for the year is included. NSA

N75-16332# Rockwell International Corp., Canoga Park, Calif.
EFFECT OF NEUTRON IRRADIATION ON TYPES 316, 321, AND SANDVIK 12R72 STAINLESS STEELS
K. R. Garr, A. G. Pard, and D. Kramer 28 Jun. 1974 20 p refs
(Contract AT(04-3)-834)
(AI-AEC-13130) Avail: NTIS HC $3.25

Samples of Types 316, 321, and Sandvik 12R72 stainless steels were irradiated in EBR-2 at 500 and 600 C. Most of the samples were Type 316 stainless steel, either cold rolled or solution annealed and aged. The other alloys were in either a solution-annealed or solution-annealed-and-aged condition. Immersion density and transmission electron microscopy (TEM) results showed that cold rolling prior to irradiation reduces the amount of swelling observed. For samples in the annealed condition and irradiated at 500 C, there was essentially no difference in swelling for the three alloys. After irradiation at 600 C, however, TEM of foil samples of Type 321 revealed very few voids, with essentially no swelling. Irradiation-induced precipitates whose size, type, and density varied with alloy, irradiation temperature, and previous treatment, were present in all alloys. The dislocation structure of the cold-worked samples was essentially unchanged after the 500 C irradiation, but was significantly altered during the 600 C irradiation. NSA

N75-16333# Sandia Labs., Albuquerque, N.Mex.
RADIATION HARDENING TECHNOLOGY
B. L. Gregory 1974 4 p refs Presented at 146th Meeting of the Electrochemical Soc., New York, 13 Oct. 1974 Sponsored by AEC
(SLA-74-5349; Conf-741013-1) Avail: NTIS HC $3.25

The radiation tolerance of semiconductor structures is influenced both by physical design and by processing details. It is found that, physical design determines the neutron tolerance

of bipolar devices, while processing details determine the tolerance of MIS structures to ionizing environments. Neutron and ionization effects on a variety of silicon semiconductor devices are discussed, and design and processing alterations to improve radiation tolerance are indicated. Author (NSA)

N75-16334# Sandia Labs., Albuquerque, N.Mex.
HARDENING QUARTZ RESONATORS TO IONIZING RADIATION: A REVIEW
J. C. King 1974 18 p refs Presented at Intern. Conf. on Evaluation of Space Environment, Toulouse, 17 Jun. 1974 Sponsored by AEC
(SAND-74-5244; Conf-740632-2) Avail: NTIS HC $3.25

The phenomenological response of precision AT-cut resonators to both steady state and pulsed radiation is briefly reviewed. The resultant frequency offset and change in resonator Q were interpreted in terms of radiation-induced changes in certain point defects in the quartz crystal structure. These defects involve interstitial monovalent cations which can be removed by solid diffusion along the optic axis at elevated temperatures in the presence of an electric field. High Q precision resonators fabricated from such swept quartz exhibit an extraordinary insensitivity to ionuzing radiation relative to untreated quartz. Author (NSA)

N75-16335# Sandia Labs., Albuquerque, N.Mex.
NEUTRAL BEAM SOURCES: APPLICATIONS IN SCIENCE AND TECHNOLOGY
W. Bauer, E. P. EerNisse, P. L. Mattern, R. G. Musket, R. W. Scmieder, and G. J. Thomas Jul. 1974 145 p refs Sponsored by AEC
(SLL-74-8204) Avail: NTIS HC $5.75

Applications of neutral beam sources in science and technology, excluding the primary use of heating controlled thermonuclear reactor (CTR) plasmas, were studied and evaluated. Current and planned neutral beam sources are described and their performance parameters are summarized. The use of neutral beams for pumping lasers, and masers, for producing neutrons and X-rays, and for CTR-related materials research is described. Suggestions for employing neutral beam sources for machining glasses and ceramics and implanting atoms in metals and semiconductors are also discussed. Author (NSA)

N75-16336# Oak Ridge National Lab., Tenn. Solid State Div.
REFLECTION OF LOW ENERGY HYDROGEN ATOMS FROM METAL SURFACES
M. T. Robinson Jun. 1974 21 p refs Presented at 3rd Natl. Conf. on Atomic Collisions with Solids, Kiev, 14-16 Oct. 1974 Sponsored by AEC
(Conf-741009-1) Avail: NTIS HC $3.25

The reflection of 50 to 500 eV H atoms from polycrystalline Cu surfaces was studied using the displacement cascade simulation program MARLOWE. The importance of inelastic effects is emphasized. Particle and energy reflection coefficients are presented as functions of the energy and angle of incidence of the projectiles. Author (NSA)

N75-16337# National Environmental Research Center, Las Vegas, Nev.
RADIOLOGICAL SURVEILLANCE PROGRAM FOR THE PROJECT GASBUGGY PRODUCTION TEST, 15 MAY - 6 NOVEMBER 1973 Final Report
Aug. 1974 63 p refs
(Contract AT(26-1)-539)
(NERC-LV-539-30) Avail: NTIS HC $4.25

The test well, located about 88 km (55 mi) east of Farmington, New Mexico, had been shut-in for about 42 months since an earlier production test. Data furnished by the El Paso Natural Gas Company indicate that a total of about 49 Ci of H-3 and about 4.7 Ci of Kr-85 was released into the atmosphere during the flaring of about 3.03 million cubic meters (107 MMCF) of natural gas. Aerial and ground surveillance teams collected environmental samples prior to, during, and after the production test. Samples of air were analyzed for Kr-85, and samples of atmospheric moisture, vegetation, soil, precipitation, and surface water were analyzed for H-3. Based upon wind patterns and aircraft trackings, samples were collected where the maximum concentrations of these nuclides would be expected to be found. Contaminated water removed from the gas was stored and injected into the flare at higher than normal rates during most of the surveillance operations. Author (NSA)

N75-16338# General Research Corp., Santa Barbara, Calif.
PHYSICAL CUSTODIAN FOR DEVELOPMENT OF ROSCOE: A RADAR AND OPTICAL SYSTEMS CODE FOR NUCLEAR EFFECTS. VOLUME 1: THE ZERO-ORDER RADAR CODE FOR ROSCOE Final Report, 27 Feb. 1973 - 27 Feb. 1974
J. A. Boys, J. Ise, L. R. Ford, J. R. Garbarino, and H. S. Ostrowsky Mar. 1974 263 p refs
(Contract DNA001-72-C-0226; DNA Proj. NWED-QAXH)
(AD-787029; GRC-CR-1-384-Vol-1; DNA-3385F-1-Vol-1) Avail: NTIS CSCL 18/3

A description of a preliminary version of the Radar and Optical Systems Code for the evaluation of nuclear effects on sensors (zero-order ROSCOE) is presented. The code consists of a working radar system simulation with crude phenomenology. Descriptions of the following systems modules are presented: attack generation, object observables, track filter, radar logic (detection, track initiation, track, and discrimination), and radar signal processing. Propagation models for such effects as noise, attenuation, clutter, refraction, and multipath are also described. (Modified author abstract) GRA

N75-16339# General Research Corp., Santa Barbara, Calif.
PHYSICAL CUSTODIAN FOR DEVELOPMENT OF ROSCOE: A RADAR AND OPTICAL SYSTEMS CODE FOR NUCLEAR EFFECTS. VOLUME 2: OPTICAL SYSTEMS MODEL FOR ROSCOE Final Report, 27 Feb. 1973 - 27 Feb. 1974
H. F. Gilmore Mar. 1974 60 p refs
(Contract DNA001-72-C-0226; DNA Proj. NWED-QAXH)
(AD-787030; GRC-CR-1-384-Vol-2; DNA-3385F-2-Vol-2) Avail: NTIS CSCL 18/3

Results are presented of a study to define an optics module for ROSCOE, comprising a Radar and Optical Systems Code for nuclear effects. The model is general enough to represent many types of optical sensors, such as air-, rocket-, and satellite-borne platforms. External factors such as target observables, optical path transmittance, stellar backgrounds, and earth limb radiance are considered in addition to nuclear effects. Systems models for optical sensor detection, tracking, and signal processing are described. Author (GRA)

N75-16473* Kanner (Leo) Associates, Redwood City, Calif.
A STUDY OF THE INTERACTION OF NEUTRAL AND CHARGED PARTICLES
V. M. Kim *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 261-263 ref Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 169-170 (For availability see N75-16452 07-93)
CSCL 20H

N75-16474* Kanner (Leo) Associates, Redwood City, Calif.
MEASUREMENT OF THE RELATIVISTIC INCREASE IN PRIMARY IONIZATION FORMED BY A CHARGED PARTICLE IN A STREAMER CHAMBER
V. A. Davidenko, B. A. Dolgoshein, V. K. Semenov, and S. V. Somov *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 264-267 ref Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 171-173 (For availability see N75-16452 07-93)
CSCL 20H

N75-16475* Kanner (Leo) Associates, Redwood City, Calif.
INSTALLATION FOR THE SEARCH OF HEAVY NON-RELATIVISTIC PARTICLES AT SEA LEVEL
A. M. Galper, V. A. Gomozov, A. F. Iyudin, Yu. D. Kotov, B. I. Luchkov, A. A. Prilepin, and A. I. Rogovskiy *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 268-271 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 174-176 (For availability see N75-16452 07-93)
CSCL 20H

N75-16478* Kanner (Leo) Associates, Redwood City, Calif.
EFFECT OF ELECTRON DIVERGENCE IN AIR GAPS ON THE MEASUREMENT OF THE ENERGY OF CASCADES IN

EMULSION CHAMBERS
A. V. Apanasenko, L. T. Baradzey, Ye. A. Kanevskaya, and Yu. A. Smorodin *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 282-286 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 183-185 (For availability see N75-16452 07-35)
CSCL 20H

N75-16480* Kanner (Leo) Associates, Redwood City, Calif.
A DISCHARGE-CONDENSATION METHOD FOR THE DETECTION OF TRACES OF CHARGED PARTICLES
Z. Sh. Mandzhavidze and V. N. Roynishvili *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 290-292 Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 187-189 (For availability see N75-16452 07-93)
CSCL 20H

N75-16482* Kanner (Leo) Associates, Redwood City, Calif.
INSTALLATION FOR THE STUDY OF THE ANGULAR DISTRIBUTION OF COSMIC MUONS WITH SUPER-HIGH ENERGIES AT LARGE ZENITH ANGLES
V. V. Borog, V. G. Kirillov-Ugryumov, A. A. Petrukhin, and V. V. Shestakov *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 298-301 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 193-194 (For availability see N75-16452 07-93)
CSCL 20H

N75-16488* Kanner (Leo) Associates, Redwood City, Calif.
BACKGROUND ESTIMATION IN A (GNU e)-DIFFUSION DETECTOR
V. I. Glotov *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 333-336 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 212 (For availability see N75-16452 07-93)
CSCL 20H

N75-16489* Kanner (Leo) Associates, Redwood City, Calif.
COMPARATIVE ANALYSIS OF ERRORS IN DIFFERENT METHODS OF CALCULATING L, B-COORDINATES
I. V. Getselev, V. A. Eltekov, V. I. Volga, and V. A. Kuznetsov *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 337-340 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 213-215 (For availability see N75-16452 07-93)
CSCL 20H

N75-16494* Kanner (Leo) Associates, Redwood City, Calif.
THE EFFECT OF THERMAL NEUTRON FIELD SLAGGING CAUSED BY CYLINDRICAL BF3 COUNTERS IN DIFFUSION MEDIA
G. V. Gorshkov, O. S. Tsvetkov, and R. M. Yakovlev *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 366-371 ref Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 229-232 (For availability see N75-16452 07-93)
CSCL 20H

N75-16497* Kanner (Leo) Associates, Redwood City, Calif.
MEASUREMENT OF SUPERSMALL QUANTITIES OF Ar37 AND H3
G. E. Kocharov and V. O. Naydenov *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 385-388 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 239-240 (For availability see N75-16452 07-93)
CSCL 20H

74 OPTICS

Includes light phenomena.

N75-16340# Aerospace Corp., El Segundo, Calif. Lab Operations.
X-RAY INELASTIC SCATTERING IN THE INTERMEDIATE MOMENTUM TRANSFER REGION: LITHIUM METAL Interim Report
Nikos G. Alexandropoulos, G. G. Cohen, and M. Kuriyama 15 Oct. 1974 12 p refs
(Contract F04701-74-C-0075)
(AD-787856; TR-0075(9260-02)-2; SAMSO-TR-74-228) Avail: NTIS CSCL 07/4

The authors report results of X-ray Compton-Raman scattering experiments in which the incident radiation was scattered by polycrystalline lithium through momentum transfer kappa/kappa (F) = 1.9,2.5,3.1,4.2. In addition to a spectral distribution in the region of the expected Compton peak and evidence of K-X-ray Raman scattering, there is also a prominent feature in the form of a peak near E/E(Fermi) = 1. The appearance of the new peak can be explained qualitatively by considering the conduction band of lithium metal to be composed of hybridized orbital electrons, and it furnishes the first evidence of the existence of an L-X-ray Raman band. Author (NSA)

N75-16341# Hughes Research Labs., Malibu, Calif.
INTEGRATED OPTICS Semiannual Technical Report, Jul. - Dec. 1973
G. Sanjiv Kamath, Amnon Yariv, R. G. Hunsperger, Michael Barnoski, and Kyohei Sakuda Jan. 1974 44 p refs
(Contract F19628-72-C-0322; ARPA Order 2074)
(AD-787781; AFCRL-TR-74-0392; SATR-3) Avail: NTIS CSCL 20/6

During this reporting period emphasis was placed mainly on improving growth techniques for epitaxial layers by the slide bar and the infinite melt methods. New slide bar assemblies made from pyrolytic graphite have eliminated many of the imperfections previously observed. More than a dozen layers were grown in the new system. Waveguiding of 1.15-micrometers light has been observed in these layers, made possible by the graded aluminum concentration profile which results from the limited melt and the segregation effect. As part of the continuing effort to evaluate device elements for which GaAs and (GaAl)As are particularly suitable, the authors have performed an analysis of an integral waveguide/detector in which proton bombardment was used to produce sensitivity to wavelengths greater than 0.9 micrometers. The authors have also evaluated the projected performance of leaky waveguides for which the guide index is less than that of the substrate. (Modified author abstract) GRA

N75-16342# General Electric Co., Philadelphia, Pa. Space Div.
SCHOTTKY BARRIER DETECTORS IN SILICON INFRARED VIDICON RETINAE Quarterly Technical Report
James P. Spratt 27 Jun. 1974 14 p refs
(Contract F19628-74-C-0142; ARPA Order 2444; AF Proj. 2444)
(AD-787777; AFCRL-TR-74-0367; QTR-1) Avail: NTIS CSCL 09/1

The objective of the contract is the design, fabrication, and evaluation of a 1-3 micrometer and a 3-5 micrometer infrared vidicon camera and camera system using Pd-Si Schottky barrier diode arrays, and metal-N type Schottky barrier diode arrays in sealed off camera tubes. GRA

N75-16343# Frankford Arsenal, Philadelphia, Pa.
ANALYTICAL STUDY OF FLUORESCENT LIGHT COLLECTORS
Joseph R. Codispoti Oct. 1973 22 p refs
(DA Proj. 1T0-61101-A-91A)
(AD-787365; FA-R-2092) Avail: NTIS CSCL 20/6

The report describes an analytical study of the light emitting properties of fluorescent cylindrical rods as a function of geometry, material absorption characteristics and pumping sourke spectrum. The approach taken involved coupling the solutions to two fundamental aspects of the overall problem: (1) the spatial distribution of fluorescent centers generated in the material by a polychromatic pumping source illuminating the cylindrical surface of the rod; and (2) the resulting propagation of the emitted fluorescent flux in the medium by total internal reflection. Analytic expressions for the output flux through the end faces were obtained through the introduction of physically reasonable approximations in the model formalism. The essential dependence of the output

characteristics on rod geometry agrees well with the experimental data available. Author (GRA)

N75-16344# RAND Corp., Santa Monica, Calif.
FAR INFRARED AND SUBMILLIMETER SCATTERING. 1: THE OPTICAL CONSTANTS OF WATER (A SURVEY)
D. Deirmendjian Feb. 1974 26 p refs
(Contract F44620-73-C-0011)
(AD-787205; R-1486-PR) Avail: NTIS CSCL 20/6

In order to correctly estimate the atmospheric attenuation of far infrared and submillimeter radiation due to scattering by cloud and rain particles it is necessary to know the corresponding optical constants of water with good accuracy. These constants, consisting of the real and imaginary parts of the complex index of refraction, are essential parameters in the use of the applicable Mie polydisperse scattering theory. They are highly wavelength dependent and, for the spectral region of interest, they could be measured only recently thanks partly to the newly available maser sources and sophisticated laboratory techniques. The most consistent sets of optical constants for water and ice are presented graphically by means of convenient plots and curves on a single figure allowing interpolation for any wavelength with reasonable accuracy. (Modified author abstract) GRA

N75-16345# Electronic Vision Corp., San Diego, Calif.
INFRARED LENS FOR 8 TO 14 MICRON WAVELENGTHS: F/.75, 100 mm Final Report, May 1971 - Feb. 1974
Walter Wysoczanski 6 Feb. 1974 70 p refs
(Contract F33615-71-C-1665)
(AD-787190; AFAL-TR-74-100) Avail: NTIS CSCL 20/6

In the course of development of a full frame nonscanning all-electronic bolometric image converting tube, a high quality infrared optical system was needed for its test and evaluation. A lens system was computer-designed and optimized, based on a previously developed design used for development of another military thermal image sensor. The fabricated lens systems consists of three multilayer antireflection coated germanium elements and one cesium iodide element. It operates in the 8 to 14 micron wavelength region with a focal ratio of 0.75, focal length of 100 mm, and a flat focal plane of about 30 mm diameter with a minimum resolution of 10 1p/mm at 10% modulation. Computer design and fabrication data is presented. Also, detailed test data is included. (Modified author abstract) GRA

N75-16346# Kansas Univ. Center for Research, Inc., Lawrence.
THEORETICAL AND EXPERIMENTAL STUDY OF WAVE SCATTERING FROM COMPOSITE ROUGH SURFACES, TASK 1 Annual Report
Robert M. Axline, Jr. and Robert Mater May 1974 129 p refs
(Contract DAAK02-73-C-0106)
(AD-787540; CRES-TR-234-2; ETL-CR-74-4; CAR-1) Avail: NTIS CSCL 20/14

The report describes the results of an electromagnetic experiment which compares measurements of scattering coefficient with non-coherent and coherent theories for two, two-dimensional, two-scale targets; one a good conductor (aluminum), and one a lossy dielectric (plaster). Included are (1) a detailed description of the construction of the two-scale scattering targets; (2) a description of the experimental 25 GHz radar system used to make scattering coefficient measurements, (3) a statistical analysis of the roughness parameters of the surface; (4) the results of the scattering coefficient measurements for the VV, HH, VH and HV polarization states; and (5) a comparison of the measurements with scattering coefficient predictions of two-scale non-coherent and coherent backscattering theories. (Modified author abstract) GRA

N75-16347# Naval Ordnance Lab., White Oak, Md.
AN OPTICAL RAY TRACING PROGRAM
Charles E. Higdon 1 May 1974 94 p refs
(AD-787636; NOLTR-74-70) Avail: NTIS CSCL 20/6

A useful aid in the design of optical systems is a digital computer program for tracing a light beam through an optical system. The optical system is comprised of a large class of reflecting and refracting optical elements which includes cylindrical optics. The mathematical technique developed for tracing rays does not require rotational symmetry and is restricted to geometrical optics. RAYTRACE, the ray tracing program, includes graphics among its output options. Author (GRA)

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N75-16348*# Stanford Univ., Calif. Inst. for Plasma Research.
COMPUTATIONAL STUDY OF NONLINEAR PLASMA WAVES: 1: SIMULATION MODEL AND MONOCHROMATIC WAVE PROPAGATION
Y. Matda and F. W. Crawford Dec. 1974 40 p refs
(Grants NGL-05-020-176; NSF GP-43703X)
(NASA-CR-142020; SU-IPR-607) Avail: NTIS HC $3.75 CSCL 20I

An economical low noise plasma simulation model is applied to a series of problems associated with electrostatic wave propagation in a one-dimensional, collisionless, Maxwellian plasma, in the absence of magnetic field. The model is described and tested, first in the absence of an applied signal, and then with a small amplitude perturbation, to establish the low noise features and to verify the theoretical linear dispersion relation at wave energy levels as low as 0.000,001 of the plasma thermal energy. The method is then used to study propagation of an essentially monochromatic plane wave. Results on amplitude oscillation and nonlinear frequency shift are compared with available theories. The additional phenomena of sideband instability and satellite growth, stimulated by large amplitude wave propagation and the resulting particle trapping, are described. Author

N75-16349# Nagoya Univ. (Japan). Inst. of Plasma Physics.
[RESEARCH PROGRESS IN PLASMA PHYSICS, INCLUDING PLASMA HEATING, CONTROL, AND PRODUCTION] Annual Review, Apr. 1973 - Mar. 1974
Apr. 1974 125 p refs
Avail: NTIS HC $5.25

Research projects on toroidal confinement of low beta plasmas are reviewed along with studies in fundamental plasma physics. Major areas of study include: (1) pinch plasmas; (2) RF plugging; (3) plasma heating; (4) laser plasma experiments; and (5) hot electron plasma experiments. Various new programs are discussed and include the following: (1) construction of JIPP-II torus; (2) RF plugging experiment on a larger scale device; (3) high-beta toroidal experiments; (4) experiments on relativistic hot electron plasma and on laser-produced plasma; and (5) application of high density relativistic electron beams. J.M.S.

N75-16350# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COMPARATIVE STUDY ON SYMMETRICAL ExH PLASMA ACCELERATOR WITH MAGNETIC QUADRUPOLE
P. I. Glazkova and S. D. Grishin 3 Oct. 1974 11 p refs
Transl. into ENGLISH from the book "Plazmennye Uskoriteli" (USSR), 1973 p 144-147
(FTD Proj. T74-04-03)
(AD-787411; FTD-HT-23-1066-74) Avail: NTIS CSCL 20/9

Experimentally studied are the electrical discharge parameters and plasma stream characteristics at the channel output of accelerators with external magnetic fields and a magnetic field with radial and axial components. GRA

N75-16351*# California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
HIGH DENSITY CONSTRAINT ON THE ENTROPY INSTABILITY
Mary K. Hudson and Charles F. Kennel Dec. 1974 16 p refs
(Grant NGL-05-007-190; Contract N00014-69-A-0200-4050)
(NASA-CR-142040; PPG-203) Avail: NTIS HC $3.25 CSCL 20I

The entropy instability squared is a nonisothermal effect which is eliminated by parallel ion pressure at high densities (k sub z lambda sub e < 1/2 sq root of m/M), reducing previous growth rate estimates and the range of unstable parameters. Author

N75-16352*# California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
THE ELECTROMAGNETIC INTERCHANGE MODE IN A PARTIALLY IONIZED COLLISIONAL PLASMA
Mary K. Hudson and Charles F. Kennel Dec. 1974 40 p refs (Grant NGL-05-007-190; Contract N00014-69-A-0200-4050) (NASA-CR-142017; PPG-201) Avail: NTIS HC $3.75 CSCL 20I

A collisional electromagnetic dispersion relation is derived from two-fluid theory for the interchange mode coupled to the Alfven, acoustic, drift and entropy modes in a partially ionized plasma. The fundamental electromagnetic nature of the interchange model is noted; coupling to the intermediate Alfven mode is strongly stabilizing for finite k sub z. Both ion viscous and ion-neutral stabilization are included, and it was found that collisions destroy the ion finite Larmor radius cutoff at short perpendicular wavelengths. Author

N75-16353*# California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
THE COLLISIONAL DRIFT MODE IN A PARTIALLY IONIZED PLASMA
Mary K. Hudson and Charles F. Kennel Dec. 1974 24 p refs (Grant NGL-05-007-190; Contract N00014-69-A-0200-4050) (NASA-CR-141984; PPG-202) Avail: NTIS HC $3.25 CSCL 20I

The structure of the drift instability was examined in several density regimes. Let sub e be the total electron mean free path, k sub z the wave-vector component along the magnetic field, and the ratio of perpendicular ion diffusion to parallel electron streaming rates. At low densities (k sub z lambda > 1) the drift mode is isothermal and should be treated kineticly. In the finite heat conduction regime square root of m/M < k sub z Lambda sub > 1) the drift instability threshold is reduced at low densities and increased at high densities as compared to the isothermal threshold. Finally, in the energy transfer limit (k sub z kambda sub e < square root of m/M) the drift instability behaves adiabatically in a fully ionized plasma and isothermally in a partially ionized plasma for an ion-neutral to Coulomb collision frequency ratio. Author

N75-16354*# Stanford Univ., Calif. Inst. for Plasma Research.
PLASMA PHENOMENA AT MAGNETIC NEUTRAL POINTS Final Report
P. A. Sturrock Feb. 1975 25 p refs
(Grants NGR-05-020-512; NGR-05-020-272)
(NASA-CR-142059) Avail: NTIS HC $3.25 CSCL 20I

A model of the plasma focus is considered, in which large axial electric fields are induced by the imploding current sheet during the final few nanoseconds of the collapse phase. This field provides a mechanism for creation of a beam of electrons of highly suprathermal energies. For this beam, the bremsstrahlung radiation is calculated, which is expected either from electron-deuteron collisions in the focused plasma itself or from the beam as it reaches the walls of the device. Comparison with experimental results indicates that the walls are the more likely source of these hard X-rays and also find qualitative agreement of the expected angular distribution of X-rays with experiment. Author

N75-16355*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
VISIBLE SPECTRAL POWER EMITTED FROM A LASER PRODUCED URANIUM PLASMA
M. D. Williams and N. W. Jalufka Jan. 1975 10 p refs
(NASA-TM-X-72626) Avail: NTIS HC $3.25 CSCL 20I

The development of plasma-core nuclear reactors for advanced terrestrial and space-power sources is researched. Experimental measurements of the intensity and the spectral distribution of radiation from a nonfissioning uranium plasma are reported. N.E.R.

N75-16356*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HEAVY ION BEAM PROBE MEASUREMENTS OF RADIAL POTENTIAL PROFILES IN THE MODIFIED PENNING DISCHARGE
George X. Kambic 1974 24 p refs Presented at 16th Ann. Meeting of the Plasma Phys. Div. of the Am. Phys. Soc., Albuquerque, New Mexico, 28-31 Oct. 1974
(NASA-TM-X-71643; E-8203) Avail: NTIS HC $3.25 CSCL 20I

A heavy ion beam probe was used to examine the radial potential profile of a plasma in the modified Penning discharge. The plasma has strong (approximately kV) electrostatic potentials near the anode ring which can be a large fraction of the injected ion beam energy. A primary (singly ionized) thallium ion beam is injected through the plasma in the midplane of a double Penning anode ring. After passage through the plasma, primary and secondary (doubly ionized) ions are detected with either a set of flat probes or an electrostatic energy analyzer. A calculation of the primary orbit through the plasma is performed to obtain an approximation to the measured primary beam trajectory. As the real radial potential profile is unknown, an adjustable model is used in the computer program. The adjustable potential profile is varied until the best agreement between measured and calculated trajectories is obtained. Secondary orbits are also predicted using the best fitting adjustable profile. The calculations indicate that secondary beams originating at more than one point in the plasma can be simultaneously observed at the electrostatic analyzer with certain primary beam initial conditions. Author

N75-16357# Japan Atomic Energy Research Inst., Tokai.
CONCEPTUAL DESIGN OF A GAS COOLED TOKAMAK REACTOR
K. Sako, M. Ohta, Y. Seki, H. Yamato, and T. Hiraoka Dec. 1973 20 p refs
(JAERI-M-5502) Avail: AEC Depository Libraries

A conceptual design of a helium cooled tokamak reactor was carried out. Core plasma, reactor structure, blanket neutronics, and material of the reactor are evaluated. The main design parameters of the fusion reactor are as follows: Reactor output 2000 MW(t), first wall loading 2 MW/sq m, plasma major/minor radius 10/2m, average toroidal magnetic field 60 kG, and reactor inlet/outlet coolant temperature 400/600 C. LI2O pebble and Incoloy 800 are used for the blanket fertile material and the first wall material, respectively. Author (NSA)

N75-16358# Nagoya Univ. (Japan). Inst. of Plasma Physics.
REPORT OF MEETING AND WORKING SESSIONS ON PLASMA HEATING
Feb. 1973 105 p refs Partly in JAPANESE and partly in ENGLISH Conf. held in Nagoya, Japan, 17-19 Jan. 1972
(IPPJ-148) Avail: AEC Depository Libraries

Various methods of plasma heating were investigated. Heating by electron cyclotron waves is a highly efficient method, and high temperatures can be obtained by this method. Obtainable electron density is limited by the cut-off frequency for microwaves. The lower hybrid wave method was studied and has good heating efficiency. The ion cyclotron wave method was studied in linear fields. Compressible Alfven waves and TTMP methods are discussed. The methods mentioned above are classified as heating by high-frequency waves. Technical problems concerning the high-frequency heating are power source, the structure of exciting system feeding power into plasma vessels and high frequency losses by the walls and others. Other methods of heating are direct current and pulse heating. Turbulent flow heating, joule heating, and theta pinch heating are discussed. Beam injection, laser, and shock methods are also explained. NSA

N75-16359# Max-Planck-Institut fuer Plasmaphysik, Garching (West Germany).
ESTIMATIONS FOR A LASER-PLASMA SOURCE
K. Buechl Dec. 1973 78 p refs In GERMAN; ENGLISH summary
(IPP-4-65A) Avail: AEC Depository Libraries HC $7.00

Estimations are described for a plasma source which can be used for filling of stellarators and other magnetic confinement devices with plasma. The estimations cover the plasma production by laser, the production of hydrogen pellets from a jet, the transfer of the pellet into high vacuum, and charging of the pellet into the focus of a laser. Author (NSA)

N75-16360# Colorado Univ., Boulder.
FINITE BOUNDARY WIDTH EFFECTS ON SURFACE WAVES

IN PLASMA Interim Report
R. L. Berger and R. E. Aamodt May 1974 16 p refs
(Contract AT(11-1)-2081)
(COO-2081-15) Avail: NTIS HC $3.25

The effect of plasma density rising smoothly from zero in a vacuum to a constant value in the plasma over a scale length L was examined in relation to its effect on surface wave modification in plasmas. The analysis covers the following topics: (1) flute formalism solutions; and (2) exact solution for electrostatic surface modes. NSA

N75-16361# Colorado Univ., Boulder.
NONLINEAR PHENOMENA IN COLLISIONLESS PLASMAS Progress Report, 1 Sep. 1973 - 31 Aug. 1974
R. E. Aamodt, R. L. Berger, and J. M. Hoffman 1974 10 p
(Contract AT(11-1)-2081)
(COO-2081-17) Avail: NTIS HC $3.25

The nonlinear development of linearly unstable modes inherent to mirror machines is analyzed theoretically in order to determine saturation amplitudes and particle loss rates for conventional devices. Nonlinear, nonlocal equations were derived for the classic drift-cone mode which incorporate the nonlinear cross field electro-convection motion. Equilibrium and stability of large amplitude transverse waves was investigated. The problem was shown to be similar in most respects to the BGK large amplitude potential model. Parametric instability studies of ionospheric and laser-pellet plasmas were completed which evaluated the effects of viscosity and plasma inhomogeneity on stimulated scattering processes. (NSA)

N75-16362# California Univ., Livermore. Lawrence Livermore Lab.
NEW APPROACHES TO CTR: GENERAL RELATIVISTIC POWER PLANTS
Lowell Wood, Thomas Weaver, and John Nuckolls 4 Mar. 1974 17 p refs Presented at Conf. on Electrostatic and Electromagnetic Confinement of Plasmas and the Phenomenology of Relativistic Electron Beams, New York, 4-6 Mar. 1974 Sponsored by AEC
(UCRL-75443; Conf-740316-6) Avail: NTIS HC $3.25

Power generation involving gravitational initiation and confinement of fusion detonation events is discussed. The prospects for reproducing on vastly smaller scales the explosions of stars themselves for powering human civilization are discussed. It is recognized that gravitational CTR may appear to be enormously more difficult in a technological sense than the challenging program of inertial fusion via laser-energized implosion. Some possible means by which these difficulties may be overcome are also discussed. Author (NSA)

N75-16363# Science Research Council, Chilton (England). Computing Applications Group
FORTRAN PROGRAMS FOR 3 SADDLE WOUND DIPOLE MAGNETS, FOR A TOKAMAK D-MAGNET AND FOR THE GEOMETRY OF THE CONSTANT PERIMETER END
H. I. Rosten May 1974 20 p
(RL-74-076) Avail: AEC Depository Libraries HC $4.00

Programs are given for the field/field integral to a given accuracy for the following current blocks: (1) helical end racetrack (pole or dipole); (2) constant perimeter end racetrack (pole or dipole; fine or coarse models); (3) the D-magnet for a tokamak fusion device. Programs are also given for the geometry of the constant perimeter end: (1) length of wire in the end, and (2) best value of cutting tool angle for constant perimeter condition. Author (NSA)

N75-16364# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LOW-FREQUENCY INSTABILITY IN RADIAL ION BEAM FORMED BY EH LAYER WITH CLOSED HALL CURRENT
V. S. Erofeev and A. V. Zharinov 2 Oct. 1974 11 p refs Transl. into ENGLISH from the monograph "Plazmennye Uskoriteli" USSR, 1973 p 71-74
(AD-787396; FTD-HT-23-1051-74) Avail: NTIS CSCL 20/9

The formation and acceleration of ion beams by a EH layer with a closed Hall current was observed. Special experiments were undertaken in order to explain the nature of the oscillations by revealing their spatial structure. The physical pattern of the instability at low accelerating voltages is explained. M.C.F.

N75-16365# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON DIMENSIONLESS GENERATION OF STATIONARY PLASMA ACCELERATOR CHARACTERISTICS
V. A. Petrosov and A. A. Porotnikov 3 Oct. 1974 14 p refs Transl. into ENGLISH from the monograph "Plazmennye Uskoriteli" USSR, 1973 p 132-136
(AD-787408; FTD-HT-23-1062-74) Avail: NTIS CSCL 20/9

Methods developed for calculating the characteristics of stationary plasma accelerators are reported. Particular attention was given to the conversion of characteristics from low models to high power accelerators. Special attention was also given to the theory of similarity and dimensional analysis. E.H.W.

N75-16366# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENTAL STUDY ON PLASMA GENERATOR WITH CATHODE DISCHARGE CHAMBER
M. M. Bachmanov and S. D. Grishin 3 Oct. 1974 12 p Transl. into ENGLISH from the book "Plazmennye Uskoriteli" (USSR), 1973 p 153-156
(FTD Proj. T74-04-03)
(AD-787400; FTD-HT-23-1069-74) Avail: NTIS CSCL 20/9

Experiments were conducted in metal discharge chambers of cylindrical or rectangular form with a thermoemission cathode. The working gas was argon and lead and bismuth vapors. Electrons were emitted into the discharge from the thermocathodes, heated either by an external source of heat or by the discharge itself. Attention was given to optimizing geometry and discharge parameters, the possibility of increasing its transverse dimensions, equalizing the density of the ion current in the output section, increasing the efficiency of electron gas ionization, and assuring its working ability over a broad density range. It was possible to decrease the nonuniformity in the ion current up to several percent with a certain increase in this quantity along the lateral walls in a chamber with a maximal cross dimension of about 250 mm. N.E.R.

N75-16367# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
QUASI-ONE-DIMENSIONAL MODEL OF PLASMA ACCELERATION IN AXISYMMETRICAL DISCHARGES WITH EXTERNAL MAGNETIC FIELD
V. A. Petrosov and I. B. Safonov 3 Oct. 1974 10 p Transl. into ENGLISH from the monograph "Plazmennye Uskoriteli" USSR, 1973 p 129-132
(AD-787409; FTD-HT-23-1061-74) Avail: NTIS CSCL 20/9

A quasi-one-dimensional model of an end type of low-current (Hall) plasma accelerator is studied. In this accelerator the prevailing influence is that of electromagnetic forces, and the internal magnetic field is much smaller than the external. GRA

N75-16368# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ENERGY CHARACTERISTICS OF COAXIAL PLASMA SOURCE
A. G. Belikov and V. P. Goncharenko 3 Oct. 1974 10 p refs Transl. into ENGLISH from the book "Plazmennye Uskoriteli" (USSR), 1973 p 200-203
(FTD Proj. T74-04-03)
(AD-787419; FTD-HT-23-1076-74) Avail: NTIS CSCL 20/9

An electrode device was used for experiments on the energy conversion coefficient of plasma generation. The energy of the plasma cluster is shown to grow linearly with the outside supply of stored energy, within the studied range of variation. The distribution of energy carried by the cluster was measured, and results are presented in tables and graphs. N.E.R.

N75-16369# National Bureau of Standards, Washington, D.C.
HIGH TEMPERATURE PLASMA RADIATION: A STUDY OF THE RECOMBINATION CONTINUUM OF ARGON IN THE ULTRAVIOLET AND OF THE CONDITIONS FOR EQUILIBRIUM IN NITROGEN ARCS Final Report, 1 Jul. 1972 - 1 Sep. 1973
R. L. Burnham and J. B. Shumaker Jun. 1974 29 p refs Prepared in cooperation with Science Applications, McLean, Va.
(Contract F33615-72-M-5012; AF Proj. 7063)
(AD-787783; ARL-74-0061) Avail: NTIS CSCL 20/9

The absolute intensity of the recombination continuum of argon was measured at wavelengths between 150 and 300 nm. The continuum radiation was produced in constricted arcs operating in argon at atmospheric pressure. The measurement of the absolute intensity of the continuum at wavelengths between 170 and 300 nm was facilitated through the use of a deuterium discharge lamp as a calibrated source of spectral radiance. Nitrogen arc measurements of the intensity of the 4915 A - 4935 A NI doublet and of the 3995 A NII line show that local thermodynamic equilibrium cannot be assumed in nitrogen arcs at electron densities below 1 x 10 to the 17th power/cc. Below this point, the results suggest that gas and electron temperatures differ significantly and that ground states are overpopulated with respect to upper electronically excited states. (Modified author abstract) GRA

N75-16370# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

DERIVATION OF SUFFICIENT CONDITIONS FOR APPLICATION OF THE DISTORTED WAVE BORN APPROXIMATION TO TURBULENT WAKE BACKSCATTER Physical Sciences Research Papers

Ronald L. Fante 21 Jun. 1974 23 p refs
(AF Proj. 2153)
(AD-787648; AFCRL-PSRP-596; AFCRL-TR-74-0281) Avail: NTIS CSCL 20/9

The distorted-wave Born approximation has been used with some success recently in predicting the radar cross section of turbulent wakes illuminated at small aspect angles. In this model the actual incident electric field within the turbulent plasma is replaced by the electric field that would be present if the random electron density (n sub e) in the plasma is replaced by the average electron density (n (ave) sub e). (This field is then used in the right-hand side of the integral equation for the scattered field to obtain the scattering cross section.) GRA

N75-16371# TRW Systems Group, Redondo Beach, Calif.

QUIPS: QUIESCENT UNIFORM IONIZED PLASMA STUDIES. MODELING OF THE AURORAL ELECTROJET Final Report, 4 May 1973 - 30 May 1974

P. H. Lee, C. F. Kennel, D. Arnush, R. L. Stenzel, and A. Y. Wong Aug. 1974 39 p refs
(Contract F30602-73-C-0293)
(AD-787866; RADC-TR-74-218) Avail: NTIS CSCL 20/9

A cylindrical device is constructed for modeling the electrojet instability. The plasma, which is collisional for ions and collisionless for electrons, is produced by two concentric RF exciter discharges in an axial magnetic field. Each exciter consists of two electrically floating concentric strips in a grounded cage. The plasma is confined axially at one end by the cage, at the other end by a segmented anode consisting of 18 concentric rings, and radially by grounded walls at large distances (d 7 or = lm). The anode rings are connected in series by resistors facilitating the imposition of a radial electric field which causes an azimuthal, closed, Hall current. The plasma density is uniform axially and azimuthally, and is controllable radially. GRA

N75-16372# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PLASMA ACCELERATORS

2 Oct. 1974 6 p Transl. into ENGLISH of the book "Plazmennye Uskoriteli" 1974 p 1-4
(AD-787410; FTD-HT-23-1041-74) Avail: NTIS CSCL 20/9

Examined are the general problems of the physics of processes in plasma accelerators, peculiarities of processes in specific types of accelerators and magnetoplasma compressors, diagnostic methods of plasma flows, and the problems of applying plasma accelerators in thermonuclear studies, gas dynamics, cosmic studies, and technology. GRA

N75-16373# Princeton Univ., N.J. Gas Dynamics Lab.

A CONTINUUM THEORY FOR THE INTERACTION OF A WEAKLY IONIZED GAS WITH AN EMITTING SURFACE

Juris Kalnavarns Jun. 1974 158 p refs
(Contract F44620-71-C-0032; AF Proj. 9783)
(AD-787884; AFOSR-74-1733TR; Rept-1135) Avail: NTIS CSCL 20/9

In problems dealing with the interaction of an ionized gas with an immersed body, the widely-used assumption that the surface acts as a perfect sink for all charged particles must sometimes be relaxed. The effects of surface electron emission (and incomplete absorption) on the behavior of a stationary, collision-dominated, weakly ionized gas in tye vicinity of a spherical probe are analyzed both in the limit of isothermal electrons and in the limit where an electron energy balance yields a variable temperature. A Knudsen layer argument relates the surface boundary conditions on the macroscopic variables to the imposed molecular conditions at the wall. Two levels of electron emission which arise naturally from the formulation are considered. (Modified author abstract) GRA

N75-16374# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PASSIVE STABILIZATION OF OSCILLATIONS IN CHANNEL OF ACCELERATOR WITH CLOSED DRIFT AND EXTENDED ACCELERATION ZONE

A. I. Morozov and V. A. Nevrovskii 3 Oct. 1974 11 p refs Transl. into ENGLISH of the book "Plazmennye Uskoriteli" USSR, 1973 p 96-99
(AD-787415; FTD-HT-23-1055-74) Avail: NTIS CSCL 20/9

The possibility is discussed of decreasing the oscillation level in the channel of an accelerator with closed drift and extended acceleration zone by means of annular electrodes and capacitances corresponding to the quantities linked to them. As indicated by experiments, stabilization effectiveness up to a certain value increases as capacitance in the area of the stabilizing ring increases depending on the state of the ring. The use of three stabilizing electrons makes it possible to decrease the oscillation amplitude of the potential in the accelerated channel to 2-5% of the discharge voltage. Author (GRA)

N75-16375# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

GEOMETRICAL OPTICS OF PLASMA OPTICAL SYSTEMS

S. V. Lebedev and A. I. Morozov 3 Oct. 1974 12 p refs Transl. into ENGLISH from the Monograph "Plazmennye Uskoriteli" USSR, 1973 p 92-96
(AD-787338; FTD-HT-23-1054-74) Avail: NTIS CSCL 20/9

The authors state the following: (1) it is theoretically possible to focus quasi-neutral ion beams by means of static electromagnetic fields; (2) the optical properties of plasma systems differ to a great extent from vacuum systems, which enables one to create plasma systems which have no analogs among the vacuum systems; (3) making the force fields in plasma systems equipotential makes it possible to vary the distribution of the electrical potential in the system over broad limits, thus enabling considerable change in the optical properties. GRA

N75-16376# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

TWO-STAGE ACCELERATION OF IONS IN LAYER WITH CLOSED HALL CURRENT

V. S. Erofeev and A. V. Zharinov 2 Oct. 1974 12 p refs Transl. into ENGLISH from the monograph "Plazmennye Uskoriteli" USSR, 1973 p 68-71
(AD-787341; FTD-HT-23-1050-74) Avail: NTIS CSCL 20/9

The effective formation and acceleration of intensive ion beams by a double electric layer with a closed Hall current was studied. Intensive radial ion beams were obtained with a high ionization coefficient for the neutrals in the first stage. It is found that focusing of the ion beam improves when the accelerating voltage is increased and the discharge voltage decreased. M.J.S.

N75-16377# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EFFECT OF INSTABILITIES DEVELOPING IN DISCHARGE IN CROSSED E AND H FIELDS ON NEAR-ANODE POTENTIAL JUMP

E. P. Vaulin and N. F. Guslyakova 3 Oct. 1974 11 p refs Transl. into ENGLISH from the book "Plazmennyye Uskoriteli" USSR, 1973 p 150-153
(FTD Proj. T74-04-03)
(AD-787347; FTD-HT-23-1068-74) Avail: NTIS CSCL 20/9

As a result of a number of experiments conducted on a device of the Homopolar type, it was found that the main quantity,

on whose change the state of the discharge depends, is the external magnetic field. The established rotation nature of the disturbance makes it possible to study the structure of the plasma column. Analyzing the distribution of the floating potential over the azimuth permits judging the distribution of the azimuthal voltage of the electrical field and the volume density of the charge and making a comparison with the distribution of the glow intensity of the argon ions over the azimuth. The behavior of the plasma in three states was analyzed. It was found that at the moment that the instability developed in the discharge channel an increase in the near-anode potential jump was observed. All characteristics of the near-anode potential jump change drastically in the critical region. Author

N75-16378# Naval Research Lab., Washington, D.C.
REPORT OF THE ATOMIC ENERGY COMMISSION ON THE NRL STUDIES CONCERNING THE TWO-COMPONENT TORUS CONCEPT Interim Report
J. P. Boris, K. R. Chu, J. H. Gardner, W. M. Manheimer, K. Papadopoulos, C. E. Wagner, and N. K. Winsor Aug. 1974 115 p refs
(NRL Proj. H02-37)
(AD-787498; NRL-MR-2878) Avail: NTIS CSCL 20/9

The Two-Component Torus Concept is considered as a Controlled Thermonuclear Fusion Research Device. Theoretical and computational studies have been performed to assess the microscopic and macroscopic plasma dynamics of such a device. Fokker-Planck studies suggest parameter ranges in which such a device might perform best. Author (GRA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N75-16379# Laboratoire d'Automatique et d'Analyse des Systemes, Toulouse (France).
ELECTRICAL CHARACTERISATION OF M-Si CONTACTS AND TECHNOLOGY CONTROL
A. Martinez, D. Esteve, and J. M. Peyriguer Apr. 1974 20 p refs Presented at the Conf. on Metal Semiconductor Contacts UMIST, Manchester, Engl., 3-4 Apr. 1974
(Publ-1117) Avail: NTIS HC $3.25

An analysis of the physical phenomena responsible for the differences obtained between theoretical characteristics and the experimental of Shottky diodes is presented. Measurements of the conduction law I (V) and low frequency noise have been carried out on Cr-Si (N) Shottky diodes. A statistical treatment of the obtained data shows that the differences with respect to the theoretical I (V) relationship can be correlated to the amplitude of the $1/f$ noise. This has been interpreted as being caused by the formation between the metal and the silicium of a composite thin film. The existence of this layer has been confirmed by analysis carried out with ionic probes. A theoretical model accounting for the conduction mechanism is presented. The electrical properties of this interface layer have been superimposed into the field effect thermonic components. Author

N75-16380# Brookhaven National Lab., Upton, N.Y.
ENERGIES OF CONDUCTION BANDS IN DIELECTRIC LIQUIDS
R. Holroyd [1974] 23 p refs Presented at the 5th Intern. Radiation Res. Congr. Meeting, Seattle, 14 Jul. 1974 Sponsored by AEC
(BNL-19058; Conf-740715-8) Avail: NTIS HC $3.25

Methods of determining the energy of the conduction band, denoted by V(0) as well as the relation of V(0) to other properties of the excess electron are discussed. Two methods of measurement are used: In one, the work function of a metal immersed in the liquid is measured. In the other, solutes (TMPD) are photoionized in the liquid and V(0) is calculated from the wavelength at which ionization onsets occur. A wide variation in conduction band energies is observed from a high of +0.21 eV for tetradecane to a low of -0.60 eV for tetramethylsilane. In general V(0) shifts to more negative values with increasing molecular symmetry, and correlates well with electron mobility. The photoionization results suggest that V(0) decreases with increasing temperature. In mixtures, V(0) is linearly dependent on mole fraction. It is found empirically for n-hexane-neopentane mixtures that log mu is linearly dependent on V(0).
Author (NSA)

N75-16381# Sandia Labs., Albuquerque, N.Mex.
COMMENTS ON THE THEORY OF LOCALIZED STATES IN NONCRYSTALLINE SEMICONDUCTING SOLIDS
D. Emin 1974 36 p Presented at the Advanced Study Institute on Physics of Structurally Disordered Solids, Kingston, Rhode Island, 29 Jul. 1974 Sponsored by AEC
(SAND-74-5238; Conf-740718-1) HC $3.75

After presenting examples of so-called localized states in crystals and commenting on the nature of electronic states in disordered solids, the question of the relationship between the nature of the eigenstates of an electron in a rigid noncrystalline solid and its transport properties is addressed. It is pointed out that the absence or presence of a finite temperature thermally-activated mobility does not necessarily follow from the electronic states being extended or localized, since electron lattice interaction often plays a major role in determining the transport properties of a solid. The effect of the electron lattice interaction on the electronic eigenstates of a deformable solid, characterized by a short range electron lattice interaction, is then discussed.
Author (NSA)

N75-16382# Knolls Atomic Power Lab., Schenectady, N.Y.
RELATING PARTICLE AND CONTINUUM MODELS FOR SMALL ELASTIC DISPLACEMENTS IN A CRYSTAL OF ARBITRARY GEOMETRY
D. M. Brudnoy 25 Jan. 1974 39 p refs
(Contract W-31-109-eng-52)
(KAPL-M-7358) Avail: NTIS HC $3.75

The general formalism of elastic deformation is treated without making any assumptions regarding the form of the matrix. After dispensing with some required definitions, the relationship between elastic constants and potential energy function is derived for arbitrary crystal geometry. The cubic and hcp crystals are brought as illustrative examples. The limit in which the continuum model equations of motion describe particle displacements is derived. The transformation properties of the stress tensor and elastic modulus tensor from unstrained to strained systems are considered. NSA

N75-16383# Utah Univ., Salt Lake City. Dept. of Physics.
SIMULTANEOUS DIFFUSION OF TWO OR MORE IONS IN THE PRESENCE OF INTERNAL ELECTRIC FIELDS
J. W. DeFord and O. W. Johnson 1974 15 p refs
(Grant DAHC15-73-G-2)
(AD-787668) Avail: NTIS CSCL 20/12

The theory of diffusion in the presence of internal electric fields developed in the preceding paper is generalized to the case of simultaneous diffusion of more than one species. It is shown that for the case of two chemically similar impurities, an experiment can be devised which virtually eliminates the effects of these internal fields, making possible accurate measurement of diffusion parameters. The theory is applied to H-D diffusion in rutile and it is shown that the main effect of the internal fields is to reduce the difference between the two diffusion coefficients while keeping the average nearly constant. Detailed calculations for the system are presented. Author (GRA)

N75-16384# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
ANNEALING OF SPUTTERED BETA SILICON CARBIDE Scientific Interim Report
Irvin Berman, Robert C. Marshall, and Charles E. Ryan 1 Oct. 1974 8 p refs
(AF Proj. 5620)
(AD-787646; AFCRL-TR-74-0485) Avail: NTIS CSCL 20/12

Using an RF sputtering and etching module silicon carbide was deposited upon the surface of (100) and (111) silicon, (111) (110) (100) tungsten, and (0001) alpha SiC. Almost all deposits were amorphous initially but after thermal annealing, the thin films on the (100) silicon and on (0001) alpha became single

crystal layers. Silicons of tungsten were formed on the tungsten substrates after annealing. Author (GRA)

N75-16385# Utah Univ., Salt Lake City. Dept. of Physics.
DIFFUSION OF H AND D IN TiO2: SUPPRESSION OF INTERNAL FIELDS BY ISOTOPE EXCHANGE
O. W. Johnson, S. H. Paek, and J. W. DeFord 1974 33 p refs
(Grant DAHC15-73-G-2)
(AD-787669) Avail: NTIS CSCL 20/12

Measurements of H and D diffusion in TiO2, using the isotope exchange technique described in the preceding paper, are reported. Use of this technique resulted in diffusion which was accurately described by Fick's law, as predicted theoretically, in sharp contrast to single ion diffusion, where dramatic departures from classical diffusion theory were observed. Ionic conductivity measurements are reported, which agree well with the bulk diffusion measurements, and permit extension of the temperature range of the measurements for c-axis diffusion from 125 to 750C, corresponding to a range of more than 4 orders of magnitude in D. The measured diffusion parameters were found to be essentially independent of sample purity, although it was observed that significant concentrations of lattice defects sharply inhibited H diffusion. (Modified author abstract) GRA

N75-16386# International Business Machines Corp., Hopewell Junction, N.Y. East Fishkill Lab.
DAMAGE PROFILES IN SILICON AND THEIR IMPACT ON DEVICE RELIABILITY Technical Report, 6 Jun. 1972 - 31 Dec. 1975
Guenter H. Schwuttke 1 Jul. 1974 66 p refs
(Contract DAHC15-72-C-0274)
(AD-787630; TR-4) Avail: NTIS CSCL 20/12

This work examines the behavior of crystal defects in silicon and their impact on semiconductor device reliability. This report substantiates previous findings of the influence of damage on the Si-SiO2 interface properties. Using the technique of impact sound stressing, micro-damage is introduced into otherwise perfect silicon surfaces in a controlled manner. Structural changes in the original defect pattern due to oxidation are studied and a cause and effect relationship between damage and oxidation is established. Dislocations are shown to transform into stacking faults, while microsplits generate dislocations and fill up with SiO2 through internal oxidation. The importance of damage-free surfaces for high quality silicon wafers is reconfirmed. Damage-free silicon surfaces are produced by pulling silicon crystals in ribbon form. (Modified author abstract) GRA

N75-16387# Aerospace Corp., El Segundo, Calif. Lab. Operations.
FRACTURE STATISTICS OF BRITTLE MATERIALS WITH INTERGRANULAR CRACKS Final Report
Samuel B. Batdorf 10 Oct. 1974 40 p
(Contract F04701-74-C-0075)
(AD-787747; TR-0075(5450-76)-1; SAMSO-TR-74-210) Avail: NTIS CSCL 20/12

A statistical theory for intergranular crack frequency as a function of crack size has been developed for polycrystalline materials. On the assumption that the cracks are penny-shaped and that brittle fracture is caused by overstressing the weakest link, the crack frequency was converted into a statistical theory of fracture. In general, the predicted behavior is in reasonable agreement with experimental observations, though whether agreement is significantly better than Weibull's theory will require detailed examination. Among the attractive features of the new theory are (1) a closer relationship to fracture mechanics and to material structure and properties compared with the Weibull theory, and (2) a capacity for refinement so as to model the actual material structure more closely, which should result in improved agreement with experiment. (Modified author abstract) GRA

N75-16388# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
THIN FILMS OF ALPHA AND BETA SILICON CARBIDE PREPARED BY LIQUID EPITAXY AND BY SPUTTERING
Charles E. Ryan, Irvin Berman, and Robert C. Marshall Jun. 1974 10 p refs
(AF Proj. 5620)
(AD-787647; AFCRL-TR-74-0484) Avail: NTIS CSCL 20/12

The preparation of thin films of alpha silicon carbide by a liquid epitaxy process is discussed. Silicon is used as a solvent at 2250 C. The silicon carbide substrate is wetted by molten silicon saturated with carbon. As the silicon evaporates, the liquid layer supersaturates precipitating carbon to form an epitaxed SIC layer on the substrate. Experiments on the wettability of silicon carbide by molten vs. temperature and the time and pressure dependence of the process are discussed. The layers formed by liquid epitaxy are used as substrates for sputter deposited beta layers which are briefly described. (Modified author abstract) GRA

N75-16389# Utah Univ., Salt Lake City. Dept. of Physics.
ANOMALOUS DIFFUSION IN NON-METALS ORIGIN AND EFFECTS OF INTERNAL ELECTRIC FIELDS
J. W. Deford and O. W. Johnson 1974 40 p refs
(Grant DAHC15-73-G-2)
(AD-787667) Avail: NTIS CSCL 20/12

When electrically active impurities or defects diffuse in a material with a band gap = 10 kT, the changing concentration of these ions may result in internal electric fields which will significantly alter the diffusion process, and result in gross misinterpretation of diffusion experiments. Equations are derived which describe the diffusion of interstitial impurities in such a system, and which take proper account of compensating immobile impurities. A technique for numerical solution of these equations is described and the results of calculations for the case of H(+) in TiO2 are presented. These calculations predict a large enhancement of the overall diffusion rate and a very distinctive concentration profile. Experimental results for the H(+)-TiO2 system are presented, which agree quantitatively with calculations. (Modified author abstract) GRA

N75-16390# Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE DEVELOPMENT OF HIGH VOLTAGES IN KDP IRRADIATED BY GAMMA RAYS
Hubert P. Yockey and Clifford L. Aseltine Jul. 1974 33 p refs
(DA Proj. 1T0-61102-B-11A)
(AD-787285; BRL-1729) Avail: NTIS CSCL 20/12

In the course of a study of the thermoluminescence of Gilliland Yockey it was discovered that intense scintillations appear during the temperature ramp. Later, the same effect was found by Yockey in potassium dihydrogen phosphate (KDP) and in triglycine sulfate (TGS). In this work the authors have obtained the optical spectrum of the pulses in two independent ways, one by photography with the aid of an image intensifier, and one by counting pulses while scanning the spectrum with a monochromator. GRA

N75-16391# Intelcom Rad Tech, San Diego, Calif.
RADIATION EFFECTS AND MATERIAL STUDIES IN PbSnTe Annual Report, 1 Aug. 1973 - 1 Sep. 1974
Howard T. Harper, Joseph F. Colwell, Barry A. Green, Roland E. Leadon, and James A. Naber 25 Sep. 1974 130 p refs
(Contract N00014-73-C-0013)
(AD-787582; RT-8040-002) Avail: NTIS CSCL 20/12

The electrical and optical properties of Pb(1-x)Sn(x)Te were measured before, during, and after various electron, gamma, and neutron irradiations, and during the subsequent isochronal annealing. These sample types fell into two categories - those with initial carrier densities (= 10 to the 17 power/cc) at 80K (the solid-state recrystallized and epitaxial thin-film samples), and one with a low carrier density (less than 10 to the 17th power/cc) at 80K (a vapor-grown sample). A measurement of the energy bandgap from optical transmission studies on the high carrier density thin-film samples after an electron irradiation at 9K revealed an increase in the bandgap energy. Modeling of the changes in the electrical and optical properties explains the changes on the basis of defects introduced by the irradiation and of the general structure of the alloy. Correlating the radiation damage as a function of irradiating particles was pursued in an effort to provide a means of predicting the relative damage to be expected in various environments. (Modified author abstract) GRA

N75-16392# Illinois Univ., Urbana. Coordinated Science Lab.
PHOTOLUMINESCENCE FROM ION IMPLANTED SILICON
Conilee Gay Kirkpatrick Aug. 1974 120 p refs
(Contract DAAB07-72-C-0259; Grants NSF GK-29714; NSF GH-40450)
(AD-787729; R-662; UILU-ENG-74-2228) Avail: NTIS CSCL 20/12

Photoluminescence studies have added new information on the nature of radiative defects resulting from the implantation of boron, phosphorus, nitrogen, carbon and oxygen ions into silicon. The influence of the species of the implanted ion, the substrate, and annealing character of the radiative centers provide substantiating evidence for the recent identification of peaks C (0.790 eV) and G (0.970 eV) with radiative recombination at a carbon modified A-center and carbon interstitialcy defect, respectively. (Modified author abstract) GRA

N75-16393# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
SUPERCONDUCTING QUANTUM DEVICES Final Report, 1 Jan. 1970 - 30 Jun. 1974
31 Aug. 1974 16 p refs
(Contract N00014-67-A-0298-0031)
(AD-787593) Avail: NTIS CSCL 09/1

The research program proposed and carried out was broadly aimed at the practical development and application of superconducting quantum devices. The major result was the successful use of these devices in ultrasensitive voltmeters and magnetometers, and the determination of the theoretical and practical limitations of these instruments in their original and subsequently improved forms. In addition, the electrical behavior of superconducting microbridge weak links was studied to understand aspects of their physical behavior with important device implications. Most of this work has been reported previously in the Technical Reports listed in the report. Finally, the authors explored the possible use of novel instrumentation and of closed-cycle cryogenic refrigerators in connection with superconducting quantum devices and reached negative conclusions as to their usefulness in the program. GRA

N75-16394# Watkins-Johnson Co., Palo Alto, Calif.
RELIABILITY TESTING OF ELECTRON BOMBARDED SEMICONDUCTOR DIODES
David H. Smith 20 Aug. 1974 46 p
(Contract N00014-72-C-0204; NR Proj. 251-005)
(AD-787599; W-J-74-4097C1) Avail: NTIS CSCL 09/1

Reliability tests of reverse biased semiconductor diodes operating in electron bombarded semiconductor devices are described. One device operating Class B at 20 W/ sq mm power dissipation density has been tested in excess of 10,000 hours. Another similar device is approaching 10,000 hours of operation. No degradation in performance characteristics has been observed in either device. The diodes used in these devices incorporate state-of-the-art passivation techniques including pillar supported integral metal beam shield.
Author (GRA)

N75-16395# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
OPTICAL WAVEGUIDES FROM SELECTED II-IV SEMICONDUCTORS BY ION IMPLANTATION AND DIFFUSION M.S. Thesis
Richard L. Morgan Jun. 1974 66 p refs
(AD-787698; GE/EE/74-29) Avail: NTIS CSCL 20/6

Several II-VI semiconductors were examined for their usability as optikal waveguides. A reproducible procedure was developed for polishing II-VI compounds to optical flatness. The procedure was especially effective for ZnSe and ZnTe. Ion implantation and diffusion were used with several combinations of dopants and substrates in attempts to produce both planar and channel optical waveguides. Proton enhanced diffusion of Cd into ZnSe produced a lossy planar waveguide, while diffusing Cd into ZnTe produced an excellent quality planar waveguide. This was the first positive proof of successful diffusion of Cd into ZnTe.
Author (GRA)

N75-16396# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
SPIN-FLIP RAMAN SCATTERING IN CADMIUM TELLURIDE M.S. Thesis
Donald E. Pusch Jun. 1974 115 p refs
(AD-787697; GE/EE/74-31) Avail: NTIS CSCL 20/12

An attempt was made to observe spin-flip Raman scattering from single crystals of n-type CdTe at liquid-helium temperatures. A 1.06 micrometer Nd:YAG laser was used as the source of pump radiation, and scattered light was collected and analyzed. A 10-tesla superconducting magnet was used. Although the spin-flip emission could not be observed, the CdTe phonon spectrum was recorded for a number of the samples. Scattering was observed from both the zone-center longitudinal optic (LO) phonon and from the zone-boundary longitudinal optic plus transverse acoustic (LO - TA) two-phonon process. Back-reflection Laue photographs were taken of the cardinal crystal planes of CdTe. Included is a general discussion of the spin-flip Raman laser and the features which make the device important in the field of laser technology, followed by a brief explanation of Landau-Raman light scattering, the basic principle underlying the spin-flip Raman laser. GRA

N75-16397# General Electric Co., Schenectady, N.Y.
STRUCTURE AND MECHANISM STUDIES OF HIGH CONDUCTIVITY SOLID IONIC CONDUCTORS Final Scientific Report, 1 Sep. 1971 - 30 Jun. 1974
J. S. Kasper and W. L. Roth Aug. 1974 126 p refs
(Contract F44620-72-C-0007; AF Proj. 9536)
(AD-787885; SRD-74-096; AFOSR-74-1606TR) Avail: NTIS CSCL 20/12

The structures and mechanisms of ion transport have been studied for key representatives of the class of superionic conductors (i.e., substances exhibiting ionic conductivity orders of magnitude larger than those of the classical defect ionic conductors). The structural and crystal chemical factors which control ionic conductivity in Type III or liquid like conductors have been determined by means of a neutron diffraction study of single crystals of beta-alumina and beta-alumina. The mechanism of ion migration in beta-alumina, and its dependence on additives of foreign ions, were investigated also by wide band nuclear magnetic resonance. Additional information was obtained by means of conductivity measurements at microwave frequency, and by experiments at very high pressure. The research effort has included a detailed investigation into the structure and conductivity of Ag2HgI4 as a prime example of the other kind of superionic conductor. Using single crystals a tetragonal structure was established whose conductivity is appreciably electronic. The details of the alpha-beta transformations at 50C were ascertained and a complete structure determination of the alpha-form was made. (Modified author abstract) GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N75-16398# Technische Universitaet, Munich (West Germany).
MERCURY BOILING WITH FORCED CONVECTION AT LOW PRESSURES IN VERTICAL TUBES Ph.D. Thesis [SIEDEN VON QUECKSILBER IM SENKRECHTEN ROHR BEI-ZWANGSKONVEKTION UND NIEDRIGEN DRUECKEN]
Hellmut Schmuecker 9 Jul. 1974 122 p refs In GERMAN; ENGLISH summary
Avail: NTIS HC $5.25

The boiling behavior of pure mercury in a vertical steel tube at low exit pressures was investigated. In the upward flow stable and unstable boiling modes were found. At the tube exit maximum mass flow rate was always established. For the stable boiling system the pressure drop and the axial distribution of heat transfer rates were determined. Visualization of the boiling zone and the two phase flow was obtained by X-ray photography. Any similarity to wellknown flow patterns was not found. An attempt was

made to determine the dynamics and the frequency of the unstable, periodic boiling mode. Author

N75-16399# Danish Atomic Energy Commission, Risoe. Physics Dept.
QUANTUM MECHANICAL OPERATOR EQUIVALENTS AND MAGNETIC ANISOTROPY OF THE HEAVY RARE EARTH METALS Ph.D. Thesis - Tech. Univ., Lyngby, Denmark
Oluf Danielsen Aug. 1973 222 p refs
(RISO-295) Avail: AEC Depository Libraries HC $14.25

A tensor operator formalism that in a convenient way describes the interactions of magnetic systems is treated. Further, a creation operator and annihilation operator formalism describing the excited states of magnetic systems is introduced. On this background, temperature laws of the magnetic anisotropy of the heavy rare earth metals are calculated. The temperature dependence of the spin wave spectrum and of the spin wave energy gap of the heavy rare earth metals is also calculated. Author

N75-16400# British Steel Corp., Sheffield (England). Information Services.
THE APPLICATION OF THERMOGRAPHY TO PLANT CONDITION MONITORING AND ENERGY CONSERVATION
L. M. Rogers Aug. 1974 11 p refs
(PB-236360/4; TB/TH/71) Avail: NTIS HC $3.25

Methods used for analyzing heat pictures obtained by thermography are discussed. Particular emphasis is placed on determining the extent and degree of refractory erosion in sealed, continuously operated installations and on determining the efficiency of thermal insulation. Examples are given of applications in the steel, petrochemical and gas industries. GRA

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N75-16401# Battelle Pacific Northwest Labs., Richland, Wash.
A TECHNIQUE FOR ENVIRONMENTAL DECISION MAKING USING QUANTIFIED SOCIAL AND AESTHETIC VALUES
J. B. Burnham, M. H. Karr, G. L. Wilfert, W. S. Maynard, S. M. Nealey, G. Jones, I. Jones, B. Gray, N. Parker, J. Coe et al Feb. 1974 247 p refs
(BNWL-1787) Avail: NTIS HC $7.50 CSCL 05A

Socual, economic and environmental tradeoffs were evaluated in the analysis of nuclear plant siting options. A method for combining social values with techno-economic values was devised, which requires that community judgements be measured on the same plant design criteria that are independently quantified on a technical basis. The social values are used as a weighting factor for the techno-economic values. A questionnaire survey was developed using three cooling design options on each of two sites chosen as test examples. The survey was administered to three separate groups, who were asked to weight several criteria for nuclear plant options by absolute and relative means. Resulzs indicate that in a follow-on test, (1) more differentiation between criteria should be established, (2) multidimensional scaling should be used to determine significant criteria, and (3) indirect and direct criteria weighting procedures should again be used. Author

N75-16402# Naval Postgraduate School, Monterey, Calif.
MISSILE ALLOCATION MODELS FOR THE ATTACK OF DEFENDED TARGETS M.S. Thesis
Supachart Boonyachan Sep. 1974 65 p refs
(AD-787372) Avail: NTIS CSCL 15/7

The models presented here are for the allocation of missiles to defended targets with a fixed force of imperfect defense missiles. The attackers will be directed first at the defense sites then at the targets themselves. The imperfect defenders are used against the attackers on a one-for-one basis as long as defenders remain. If any attacker penetrates the defense site, all the defenders at that defense site are destroyed. The problems addressed are the offensive problems of determining how many attackers to send to each defense site and to the target complex. The necessary mathematical relationships are derived and used to obtain graphical results. Author (GRA)

N75-16403# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LONGE-RANGE FORECASTING OF SCIENTIFIC TECHNOLOGICAL PROGRESS
V. Siforov 25 Sep. 1974 21 p Translated into ENGLISH of the Mono. Tero. Prakt. Prognirovaniya Razvitia Nauk i Tekhn. v Stranakh Chlenakh Sev, 1971 p 54-63
(AD-787399; FTD-HC-23-2335-74) Avail: NTIS CSCL 05/1

Classification of forecasts is known as first echelon--for 15-20 years ahead; second echelon--for the first decade of the 21st century; and third echelon--for approximately 100 years ahead. At the present time there is a necessity to speak of a fourth echelon of long-range forecasting for an even longer period of time--for several centuries, and perhaps even longer. The report deals with the questions: Is it necessary to be concerned with so long-range a forecast; and is it necessary in light of the tasks that stand before us in the contemporary situation. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N75-16404# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
AN ECONOMIC EVALUATION OF THE UTILITY OF ERTS DATA FOR DEVELOPING COUNTRIES, VOLUME 1 Final Report, 30 Jun. 1973 - 30 Jun. 1974
D. S. Lowe, R. A. Summers, and E. J. Greenblat Aug. 1974 101 p
(Contract AID/CM/ta-C-73-38)
(PB-236600/3; ERIM-105100-8-F) Avail: NTIS HC $5.25 CSCL 05C

The utilization of ERTS-1 data in 18 developing countries is reviewed and evaluated. This overall assessment is supported by more detailed economic evaluations in selected countries. Two quantitative economic evaluations were conducted, one on the benefits to be derived from improved rice-crop forecasting in Thailand and the other on benefits stemming from improved range-carrying-capacity estimations in Kenya. Additional qualitative evaluations were made of potential improvements in mineral exploration, water resources management, and cartographic mapping. These benefits can be accrued at acceptably low cost levels, provided that appropriately timed and scaled technical assistance is provided. GRA

N75-16405# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
AN ECONOMIC EVALUATION OF THE UTILITY OF ERTS DATA FOR DEVELOPING COUNTRIES. VOLUME 2: APPENDICES Final Report, 30 Jun. 1973 - 30 Jun. 1974
D. S. Lowe, R. A. Summers, and E. J. Greenblat Aug. 1974 311 p
(Contract AID/CM/ta-C-73-38)
(PB-236601/1; ERIM-105100-8-F) Avail: NTIS HC $9.25 CSCL 05C

The utilization of ERTS-1 data in 18 developing countries is reviewed and evaluated. An overall assessment is supported by

more detailed economic evaluations in Bolivia, Thailand, Kenya and Botswana. While organizational and technical progress varies widely, it seems clear that substantial benefits can accrue to these countries in cartographic mapping, mineral exploration, water resources management, range management, crop forecasting, and rural/regional development. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N75-16406# Civil Aeronautics Board, Washington, D.C.
REMARKS
Robert D. Timm 1974 9 p Presented at the Financial Times, World Air Transport Conf., London, 8 May 1974
Avail: NTIS HC $3.25

The economic stresses and strains felt by the civil aviation industry around the world are discussed. Factors considered are: increasing operating costs; the fuel crisis; a decrease in technological advancement; limiting the expansion of the international route network; and a constructive profit producing fare structure. J.M.S.

N75-16407# Royal Aircraft Establishment, Farnborough (England).
COST ACCOUNTING AT LARGE RESEARCH CENTRES
J. Schulte-Hillen Oct. 1974 156 p refs Transl. into ENGLISH from Deut. Luft- und Raumfahrt, Report DLR-FB-73-64, 1973 (RAE-Lib-Trans-1765; BR44769; DLR-FB-73-64) Avail: NTIS HC $6.25

A survey of cost accounting at the leading German large-scale research centers is given, followed by an investigation of the legal aspects considered in designing a system of cost accounting in major research. The objectives of a cost accounting system geared to the responsibilities of major research are described along with methods of cost accounting applicable to major research. A system of cost accounting based on the principle of direct costing is developed. The proposed method consists of cost, category, cost center, and cost unit accounting, each of which is expanded only to an extent which is absolutely necessary for research. Author

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category .

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N75-16408*# George Washington Univ., Washington, D.C.
THE SOUTHERN REGIONAL CONFERENCE ON TECHNO-ASSESSMENT: SUMMARY
Vary T. Coates and John E. Mock Oct. 1974 44 p Sponsored by NSF
(Grant NGL-09-010-030; Contract ERP-3-05807-A01)
(NASA-CR-142006) Avail: NTIS HC $3.75 CSCL 05A

The proceedings of a conference on technology assessment are presented. A survey of recent Federal activity in technology assessment was discussed initially. Emphasis was placed on state and local activities with respect to technology assessment to include the following subjects: (1) the technology assessment desired by states, (2) organization of technology assessment activities, (3) how to perform technology assessments for less than $5,000, and (4) the preparation of environmental impact statements. Specific application of technology assessment to solid waste management in Connecticut is reported. Author

N75-16409*# National Aeronautics and Space Administration, Washington, D.C.
TECHNOLOGY UTILIZATION PROGRAM REPORT, 1974
Owen Carlson, ed., Laszlo Dosa, ed., and William Leavitt, ed. 1975 96 p Original contains color illustrations
(NASA-SP-5120) Avail: NTIS MF $2.25; SOD HC $2.10 CSCL 05B

The adaptation of various technological innivations from the NASA space program to industrial and domestic applications is summarized. N.E.R.

N75-16410# Committee on Public Works (U. S. Senate).
TRANSPORTATION AND THE NEW ENERGY POLICIES: TRUCK SIZES AND WEIGHTS, PART 2
Washington GPO 1974 676 p refs Hearings before Subcomm. on Transportation of Comm. on Public Works, 93d Congr., 2d Sess., 20-21 Feb. and 26 Mar. 1974
(GPO-29-802) Avail: Subcomm. on Transportation

The effect of increasing allowable sizes and weights of motor vehicles using our highways is examined. Factors considered are: (1) reduction of energy consumption; (2) impact on highways and bridges; (3) deterioration in highway safety; (4) rising maintenance and construction costs of highways; (5) lower operating costs to truckers; (6) lower transportation costs to shippers; and (7) decrease in price of goods to consumers. J.M.S.

N75-16411# Committee on Public Works (U. S. Senate).
IMPLEMENTATION OF TRANSPORTATION CONTROLS, HOUSTON, TEXAS AND NEW YORK, NEW YORK, PART 3
Washington GPO 1974 1243 p refs Hearing before Subcomm. on Environ. Pollution of Comm. on Public Works, 93d Congr., 2d Sess., 1-2 May 1974
(GPO-33-956) Avail: Subcomm. on Environ. Pollution

The relationship between the implementation of transportation controls and the attainment of the air quality standards as stated in the Clean Air Act is examined. Arbitrary regulation in the state of Texas of vehicle and pollution emission sources by EPA is discussed along with transportation control strategies implemented by New York. Environmental and economic factors are considered. J.M.S.

N75-16412# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
LINEARIZED MODELS, STABILITY CRITERIA AND EXPERIMENTAL VERIFICATION FOR PLENUM AIR CUSHIONS WITH COMPRESSOR-DUCT INTERACTIONS Final Report, Oct. 1972 - Dec. 1973
L. M. Sweet, H. H. Richardson, and D. N. Wormley May 1974 127 p refs
(Contract DOT-FR-10007)
(PB-235750/7; FRA-ORD/D-74-40) Avail: NTIS HC $5.75 CSCL 13F

An analytical and experimental investigation of the static and dynamic behavior of nearly full scale pleunum-type air cushion suspensions is described, including the effects of compressor-duct dynamics and secondary suspension characteristics. The results indicate that cushion duct interactions may strongly affect cushion stability unless the lowest resonant frequency of the duct is much higher than the cushion unsprung mass natural frequency. Criteria are suggested for selecting appropriate duct models for use in suspension dynamic analysis. For most practical systems a second- or at most fourth-order duct model will adequately represent the distributed duct dynamics. GRA

N75-16413# Voorhees (Alan M.) and Associates, Inc., McLean, Va.
TRANSPORTATION POOLING

Jan. 1974 294 p
(PB-236157/4; UMTA-IT-06-0092-74-1) Avail: NTIS HC $8.75 CSCL 13B

With the advent of impending energy shortages in the winter of 1973-74, the U.S. Department of Transportation embarked on an accelerated program to promote increased use of high-occupancy vehicles-transit and carpools. As part of this program a series of reports were prepared that summarized the major aspects of carpool programs designed to assist local areas in initiating successful pooling action programs. This report is a collection of the ten individual reports. The goal of the Carpool/Buspool Program is to satisfy travel requirements more efficiently by increasing passenger occupancy in autos and buses. Achievement of that goal calls for coordination among many institutions within a metropolitan region including public agencies and citizen and business groups. The information and techniques presented should be considered as a guide to the development of a sound program in a metropolitan area. GRA

N75-16414# Northeastern Univ., Boston, Mass. Center for Continuing Education.
PROCEEDINGS OF THE WORKSHOP ON MOVING WAY TRANSPORTATION SYSTEMS
Jul. 1974 315 p refs Conf. held in Boston, 5-7 Nov. 1973 Sponsored by DOT
(PB-236348/9; UMTA-MA-11-0006-74-1) Avail: NTIS HC $9.25 CSCL 13F

Moving way transportation systems are described as constituting means for massive movement of people in cities and in such places as airports, sprawling university campuses, shopping centers, rapid transit stations and the like, where traffic congestion or considerable walking distances occur. Principal issues affecting the development and implementation of moving way systems in the U.S. and abroad are discussed with a view to exchanging related socio-economic and technical concepts among the participants. Engineering and economic data are presented. Questions of need, safety, financing, public acceptance, and implementation of moving way transportation systems are discussed with the development of a regard for the difficult problems that remain to be solved. GRA

N75-16415# Transportation Research Board, Washington, D.C.
ISSUES IN STATEWIDE TRANSPORTATION PLANNING
Roger L. Creighton Feb. 1974 269 p refs Conf. held at Williamsburg, Va., 21-24 Feb. 1974
(PB-235165/8; TRB-SR-74-146) Avail: NTIS HC $8.50 CSCL 13B

Summaries of the findings of the workshops and of the conference papers are followed by descriptions of research projects that were recommended to be undertaken to give statewide transportation planning the methodological base and administrative direction required. Issues given primary consideration were analytical techniques for developing multimodal transportation alternatives; measuring performance of major transportation modes in terms of user, community, environmental, and operator costs; and estimating dollar costs and social benefits of alternative growth patterns and transportation systems to serve them. GRA

N75-16416# Boeing Vertol Co., Philadelphia, Pa. Surface Transportation Systems Dept.
SOAC (STATE-OF-THE-ART CAR) DEVELOPMENT PROGRAM. VOLUME 1: DESIGN, FABRICATION AND TEST Final Report, Jun. 1971 - Aug. 1973
Apr. 1974 193 p refs
(Contract DOT-UT-10007)
(PB-235703/6; D174-10031-1; UMTA-IT-06-0026-74-1) Avail: NTIS HC $7.00 CSCL 13F

Design, fabrication and test of two new state-of-the-art cars (SOAC) whose objective is to demonstrate the current state-of-the-art in rail rapid transit vehicle technology were carried out. Passenger convenience and operating efficiency were primary goals. The SOAC features a DC-DC chopper in the propulsion system, separately excited DC traction motors, all-steel construction (with molded fiberglass ends), and vandal-resistant and fire-retardant materials in the interior. The development program through engineering testing, including data on design and performance, propulsion and braking, subsystems, test program, mockup and demonstration programs, and economic analysis is presented. GRA

N75-16417# Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
THE ELECTRICAL PROCESS IN THE BREAKING OF DILUTE OIL-IN-WATER EMULSIONS Final Report, 1 Jul. 1973 - 30 Jun. 1974
Clyde Orr, Jr. and Edward Y. H. Keng Jun. 1974 25 p refs
(Contract DI-14-31-0001-4010)
(PB-235908/1; ERC-0674; W74-12343; OWRR-A-049-GA(1)) Avail: NTIS HC $3.25 CSCL 13B

This study sought to assess the usefulness of electrical measurements. Particularly the so-called zeta potential, in guiding the treatment process to chemicals and application rates that can break measured emulsions. When the zeta potential, which for a highly stable emulsion may be as negative as -0.090 volt, is made to approach -0.015 volt, the stability of the emulsion deteriorates rapidly. Past this point, oil-in-water emulsion often break spontaneously. The larger drops will then rise to the water surface and form a distinct oil layer that can be easily removed. Laboratory applications of various chemicals to emulsions samples and subsequent zeta potential measurement should thus provide a ready guide to those trying to remove oily waste water discharge. (Modified author abstract) GRA

N75-16418# Rochester Univ., N.Y.
SCIENCE AND TECHNOLOGY IN THE CORPORATE SEARCH FOR ORDER: AMERICAN ENGINEERS AND SOCIAL REFORM, 1900-1929 Final Report
David Franklin Noble May 1974 566 p refs
(Grant DL-91-36-72-39)
(PB-236375/2; DLMA-91-36-72-39) Avail: NTIS HC $13.00

Technology as a social process is examined. Emphasis is placed on the experience of American engineers in the early 20th Century. The development of the primary products of the 19th Century wedding of science to the useful art is traced. It is indicated that the large corporations undertook to manage the process of technology upon which they and the engineering profession were grounded. Corporate-minded engineers in the industries, the professional societies, and the schools sought reforms which included scientific and industrial standardization, the organization of industrial and university research, and reforms of the patent system and education. (Modified author abstract) GRA

N75-16419# Iowa State Univ. of Science and Technology, Ames. Engineering Research Inst.
INTEGRATED ANALYSIS OF SMALL CITIES INTERCITY TRANSPORTATION TO FACILITATE THE ACHIEVEMENT OF REGIONAL URBAN GOALS Final Report
K. A. Brewer, R. O. Richards, R. L. Carstens, S. L. Ring, and M. L. Millet, Jr. Jun. 1974 653 p refs
(Contract DOT-OS-30106)
(PB-236612/8; ISU-ERI-Ames-74067; ISU-ERI-Ames-74129) Avail: NTIS HC $15.25 CSCL 13B

The research focuses upon intercity transportation and its relationship to socioeconomic characteristics in essentially rural regions. The study area consists of the nine administrative planning regions in Iowa that do not include a community of 50,000 population or more. The objective was to relate the intercity transportation system of small urban communities to their ability to attract and absorb growth. This relationship, as established, suggested a structured set of conditions regarding transportation planning, regulation, policies, and programs that would be supportive of growth in the study regions and in similar rural regions in other states. GRA

N75-16420# Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
FIELD TEST OF AN ENVIRONMENTAL IMPACT ASSESSMENT METHODOLOGY M.S. Thesis
Martin A. Smith Aug. 1974 206 p refs Sponsored in part by EPA
(PB-236045/1; ERC-1574; W74-12357) Avail: NTIS HC $7.25 CSCL 13B

A field application is described of an environmental impact assessment methodology designed by Battelle Memorial Institute

(Columbus Laboratories) for the Georgia Department of Transportation to one rail line of the planned Metropolitan Atlanta rapid transit system. The methodology, among the most rigorous and explicit of the available impact evaluation techniques, used a number of value function for converting information on a wide variety of dissimilar environmental effects to commensurable quantitative units. The conversion permits aggregation and evaluation of overall environmental impact and of tradeoffs among individual effects. Alternate value functions can be readily explored, and new ones can be added as desired. GRA

N75-16421# Tri-State Regional Planning Commission, New York.
URBAN CORRIDOR DEMONSTRATION PROGRAM MANHATTAN CBD-NEW JERSEY CORRIDOR. AUTOMATIC BUS IDENTIFICATION Final Report
Jun. 1974 270 p refs Sponsored in part by New Jersey Dept. of Transportation, New Jersey Turnpike Authority, Port Authority of New York and New Jersey and Transport of New Jersey
(Contract DOT-FH-11-7778)
(PB-235061/9; TS-7930-ABI) Avail: NTIS HC $8.50 CSCL 13B

The purpose of the Automatic Bus Identification Project was fourfold: to evaluate the performance of automatic vehicle identification (AVI) systems on buses in normal field operations; to consider the potential benefits of AVI for monitoring bus movemenzs, including nonstop toll collection; to develop methods of coding and numbering that could be used as a standard for AVI systems; and to prepare specifications for an AVI system based on test results. The objectives of the project were met by conducting a two-phase test program. The first phase supplied road-side interrogators to monitor bus passage in a closed loop system. The second phase was designed to provide a rigorous analysis of the performance of each AVI system. GRA

88 SPACE SCIENCES (GENERAL)

N75-16422*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SIGNIFICANT ACCOMPLISHMENTS IN SCIENCE AND TECHNOLOGY
Washington 1975 360 p Symp. held at Greenbelt, Md., 18-19 Dec. 1973
(NASA-SP-361) Avail: NTIS HC $10.00 CSCL 22A

The proceedings of a symposium on significant accomplishments in science and technology are presented. The symposium was held at the Goddard Space Flight Center in December 1973. The subjects discussed are as follows: (1) cometary physics, (2) X-ray and gamma ray astronomy, (3) solar and terrestrial physics, (4) spacecraft technology, (5) Earth Resources Technology Satellite, (6) earth and ocean physics, (6) communications and navigation, (7) mission operations and data systems, and (8) networks systems and operations. For individual titles, see N75-16423 through N75-16431.

N75-16423* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMETARY PHYSICS **c89**
In its Significant Accomplishments in Sci. and Technol. 1975 p 2-33 (For availability see N75-16422 07-88)
CSCL 03A

A history of comets and cometary observations is presented. Emphasis is placed on the observations and characteristics of the Comet Kohoutek. A schematic drawing of a comet is included to show the structure of the nucleus, coma, dust tail, ion tail, and natural hydrogen cloud. A joint observatory for cometary research, located in New Mexico, is described. Observations of magnetic fields in comets are analyzed. Infrared spectral observations of comet structure in the 10 micron atmospheric window are reported. P.N.F.

N75-16424* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
X-RAY AND GAMMA-RAY ASTRONOMY **c89**
In its Significant Accomplishments in Sci. and Technol. 1975 p 34-91 (For availability see N75-16422 07-88)
CSCL 03A

Accomplishments in the fields of X-ray and gamma ray astronomy are discussed. Data obtained from IMP and OGO satellites are analyzed to determine the sources of interplanetary radiation bursts. The energy spectrum of cosmic gamma ray bursts as observed by IMP-6 is described. The application of cooling blackbody techniques as a method for examining cosmic gamma ray bursts is reported. The experimental results and theoretical interpretation of high energy diffuse gamma rays are investigated. The structure of the SAS-2 satellite is depicted and the accomplishments are examined. Other sources of gamma radiation to include galactic fermi, Cygnus X-1, supernovae, and the planet Jupiter are proposed. Data obtained from the Pioneer 10 space probe are presented in graph form. P.N.F.

N75-16425* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR AND TERRESTRIAL PHYSICS **c92**
In its Significant Accomplishments in Sci. and Technol. 1975 p 92-138 (For availability see N75-16422 07-88)
CSCL 03B

The effects of solar radiation on the near space and biomental earth, the upper atmosphere, and the magnetosphere are discussed. Data obtained from the OSO satellites pertaining to the solar cycle variation of extreme ultraviolet (EUV) radiation are analyzed. The effects of solar cycle variation of the characteristics of the solar wind are examined. The fluid mechanics of shock waves and the specific relationship to the characteristics of solar shock waves are investigated. The solar and corpuscular heating of the upper atmosphere is reported based on the findings of the AEROS and NATE experiments. Seasonal variations of the upper atmosphere composition are plotted based on OGO-6 mass spectrometer data. P.N.F.

N75-16426* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPACECRAFT TECHNOLOGY **c18**
In its Significant Accomplishments in Sci. and Technol. 1975 p 139-178 (For availability see N75-16422 07-88)
CSCL 22B

Developments in spacecraft technology are discussed with emphasis on the Explorer satellite program. The subjects considered include the following: (1) nutational behavior of the Explorer-45 satellite, (2) panoramic sensor development, (3) onboard camera signal processor for Explorer satellites, and (4) microcircuit development. Information on the zero gravity testing of heat pipes is included. Procedures for cleaning heat treated aluminum heat pipes are explained. The development of a five-year magnetic tape, an accurate incremental angular encoder, and a blood freezing apparatus for leukemia research are also discussed. P.N.F.

N75-16427* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EARTH OBSERVATIONS **c43**
In its Significant Accomplishments in Sci. and Technol. 1975 p 179-233 (For availability see N75-16422 07-88)
CSCL 08G

The development of the Earth Resources Technology Satellites for making earth observations from space is discussed. The programmatic elements of the ERTS program are defined. The specific results of the program which are considered are as follows: (1) analysis of snowmelt runoff, (2) analysis of Mississippi River floods of 1973, (3) global ice surveys with an electrically scanning microwave radiometer, (4) the microwave signature of snow fields, (5) analysis of strip mining activities, (6) sea surface studies using microwave techniques during the Bering Sea experiment, (7) cloud types and measurement of rainfall, and (8) performance of various remote sensors. P.N.F.

N75-16428* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EARTH AND OCEAN PHYSICS **c48**
In its Significant Accomplishments in Sci. and Technol. 1975 p 234-249 (For availability see N75-16422 07-88)
CSCL 08J

A procedure for obtaining a parameterization of the marine geoid for suitable orthogonality properties in altimetry data is discussed. The application of the technique to the Puerto Rico trench is explained and a map of the data is developed. The Goddard Earth Model (GEM-6) is described to show the method for determining the earth gravity field using data obtained from satellite tracking stations. The deviation of a global ocean tide model from satellite data is explained. The influence of solid earth and ocean tides on the inclination of GEOS-1 is plotted. The delineation of the geographical fracture pattern and boundary system of the tectonic plates using ERTS satellite is shown.
P.N.F.

N75-16429* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMMUNICATIONS AND NAVIGATION c32
In its Significant Accomplishments in Sci. and Technol. 1975 p 250-289 (For availability see N75-16422 07-88)
CSCL 17B

The use of a computer simulation to quantitatively measure the distortion on a standard video test signal which experiences frequency modulation, filtering, and frequency demodulation is discussed. The process is applied to frequency modulated television systems for use with the ATS-F spacecraft. A block diagram of the system is presented. The characteristics of a millimeter wave space communication system are analyzed. The application of the Omega Position Location Equipment (OPLE) for a global rescue net is reported. The development of a high speed photodetector for the neodynium yag laser system is discussed and the characteristics of the system are explained. The effects of gas pressure on waveguide laser tunability are examined.
P.N.F.

N75-16430* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MISSION OPERATIONS AND DATA SYSTEMS c12
In its Significant Accomplishments in Sci. and Technol. 1975 p 290-319 (For availability see N75-16422 07-88)
CSCL 22A

A communications system for performing the basic functions of mission operations, orbit and attitude determination, and data processing is described. A block diagram is provided to show the relationships of these functions with the spacecraft in orbit and the experiments to be conducted on board the spacecraft. Specific areas of application are discussed as follows: (1) software operating systems for the ATS-F satellite testing and ground support, (2) inversion of the RAE-1 satellite (Explorer 38 satellite) in orbit, (3) ALSEP differential Doppler tracking, (4) minitrack calibration using satellite data, (5) angles-only orbit extraction, and (6) image processing system performance prediction and product quality evaluation techniques. Block diagrams of the various systems are provided to show the steps involved in the operations.
P.N.F.

N75-16431* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NETWORKS SYSTEMS AND OPERATIONS c32
In its Significant Accomplishments in Sci. and Technol. 1975 p 320-348 (For availability see N75-16422 07-88)
CSCL 17B

The application of wideband communication techniques for data links with satellites is discussed. A diagram of the demand assigned voice communications system is provided. The development of prototype integrated spacecraft paramps at S- and C-bands is described and the performance of space-qualified paramps is tabulated. The characteristics of a dual parabolic cylinder monopulse zoom antenna for use with the tracking and data relay satellite system (TDRSS) are analyzed. The development of a universally applicable transponder at S-band is reported. A block diagram of the major subassemblies of the S-band transponder is included. The technology aspects of network timing and synchronization of communication systems are to show the use of the Omega navigation system. The telemetry data compression system used during the Skylab program is evaluated.
P.N.F.

N75-16432*# National Aeronautics and Space Administration, Washington, D.C.
SPACE SCIENCE
Jan. 1975 45 p
(NASA-News-Release-75-19) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Maryland 20740 CSCL 22A

A fact sheet on the NASA space science program is presented. Some of the subjects considered include the following: (1) the Orbiting Astronomical Observatory, (2) the Orbiting Solar Observatory, (3) the Small Astronomy Satellite, (4) lunar programs, (5) planetary programs using the Mariner, Pioneer 10, and Viking space probes, and (6) the Scout, Thor-Delta, and Atlas-Centaur launch vehicles. For each program there is a description of the effort, the schedule, management, program officials, and funding aspects in outline form.
P.N.F.

N75-16433# Committee on Science and Astronautics (U. S. House).
FEDERAL POLICY, PLANS, AND ORGANIZATION FOR SCIENCE AND TECHNOLOGY, PART 2
Washington GPO 1974 830 p refs Hearings before Comm. on Sci. and Astronaut., 93d Congr., 2d Sess., No. 50, 20, 25-27 Jun. and 9-11, 16-18 Jul. 1974
(GPO-37-898) Avail: SOD HC $6.50

The views, commentary, and criticisms on the background and present status of the Federal posture on science and technology of nongovernment witnesses is presented. A broad variety of scientific and technological background and thought is represented. Emphasis is placed on the decreasing governmental support of research and development programs and the subsequent economic impact.
J.M.S.

N75-16434*# National Aeronautics and Space Administration, Washington, D.C.
NASA'S UNIVERSITY PROGRAM: ACTIVE GRANTS AND RESEARCH CONTRACTS, FISCAL YEAR 1974
1974 306 p refs
(NASA-TM-X-72719) Avail: NTIS HC $9.25 CSCL 05B

Each entry includes institution and location, brief description of project, period of performance, principal investigator at institution, NASA technical officer (monitor), sponsoring NASA installation, interagency field of science or engineering classification C.A.S.E. category, grant or contract number, FY 74 obligations, cumulative obligations, and most recent RTOP coding. Entries are arranged alphabetically within state or country. Four cross indices are presented: (1) grant or contract number; (2) C.A.S.E. field or science or engineering; (3) NASA technical officer location; and (4) RTOP code.
Author

N75-16435# Naval Research Lab., Washington, D.C.
REPORT OF NRL PROGRESS, APRIL 1974 Monthly Report
William M. Leak and Daniel R. Nelson Apr. 1974 71 p refs
(PB-235993/3) Avail: NTIS HC $4.25 Also available from NTIS on subscription $22.50/year domestic, $28.25/year foreign CSCL 05B

Contents: Laboratory for chemical physics; wave-damping and film-pressure studies of polydimethylsiloxane monolayers on organic liquid substrates; acoustics; atmospheric physics; chemistry; mathematics; metallurgy; nuclear sciences; ocean technology; optical physics; radio and radar; solid state physics; space systems.
GRA

N75-16436# Naval Research Lab., Washington, D.C.
REPORT OF NRL PROGRESS
Mar. 1974 69 p refs
(PB-235299/5) Avail: NTIS HC $4.25 Also available from NTIS on subscription $22.50/year domestic, $28.25/year foreign CSCL 05B

Contents: The communications sciences division-three challenges for 1975-80; linear predictive narrowband voice digitizer; a method of detecting the presence of a shear pin in the Ex161 primer; progress notes in the following areas: acoustics; communications sciences; metallurgy; nuclear sciences; radar; space science; patents.
GRA

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N75-16437*# Texas A&M Univ., College Station. Dept. of Physics.
HIGH DISPERSION OBSERVATIONS OF VENUS DURING 1972. THE CO2 BAND AT 7820 ANGSTROM
L. D. Gray Young (Nicholas Copernicus Univ.), A. T. Young, and A. Woszczyk 31 Jan. 1975 56 p refs
(Grant NGR-44-001-117)
(NASA-CR-142023; Rept-15) Avail: NTIS HC $4.25 CSCL 03A

Photographic plates of Venus which show the spectrum of the carbon dioxide band at 7820A were obtained at Table Mountain Observatory in September-October 1972. These spectra showed a semi-regular 4-day variation in the CO2 abundance over the disk of the planet. Evidence for temporal variations in the rotational temperature of this band and temperature variations over the disk was found. The two quantities, CO2 abundance and temperature, do not show any obvious relationship; however, an increase in the temperature usually is accompanied by a decrease in the abundance of CO2. The average temperature, found from a curve of growth analysis assuming a constant CO2 line of width, is 249 plus or minus 1.4 K (one standard deviation). Author

N75-16438# California Univ., Livermore. Lawrence Livermore Lab.
NUMERICAL STUDY OF PROTOSTELLAR FORMATION Ph.D. Thesis
C. K. Westbrook 8 Mar. 1974 93 p refs
(Contract W-7405-eng-48)
(UCRL-51552) Avail: NTIS HC $4.75

The earliest phase in the evolution of a star is the formation of a gravitationally bound gas cloud from the interstellar medium. This cloud mass is not, in general, in hydrostatic equilibrium, and will evolve hydrodynamically until equilibrium is attained. The protostellar evolution of these gas clouds is examined. A mathematical model is presented treating all the appropriate physical processes which are important during protostar formation including hydrodynamics, thermodynamics and equation of state, radiation transport, and convective energy transport. Important features of the mathematical model are use of temperature or specific energy density as an independent parameter rather than energy flux or luminosity and inclusion of all time derivatives from the differential equations.
Author (NSA)

N75-16423* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMETARY PHYSICS
In its Significant Accomplishments in Sci. and Technol. 1975 p 2-33 (For availability see N75-16422 07-88)
CSCL 03A

N75-16424* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
X-RAY AND GAMMA-RAY ASTRONOMY
In its Significant Accomplishments in Sci. and Technol. 1975 p 34-91 (For availability see N75-16422 07-88)
CSCL 03A

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N75-16439*# California Inst. of Tech., Pasadena. Div. of Geological and Planetary Sciences.
PETROGENESIS OF LUNAR ROCKS: Rb-Sr CONSTRAINTS AND LACK OF H2O
Arden L. Albee and Alexander J. Gancarz 1974 24 p refs Presented at the Soviet-Am. Conf. on the Cosmochem. of the Moon and Planets, Moscow, 4-8, Jun. 1974
(Grants NGL-05-002-188; NGL-05-002-338)
(NASA-CR-142007; Contrib-2474) Avail: NTIS CSCL 03B

Rb and Sr isotopic data and other chemical data indicate major lunar differentiation at about 4.6 AE and very limited subsequent differentiation. The constraints of limited differentiation post 4.6 AE and the apparent lack of H2O on the moon, when applied to the derivation and petrogenesis of lunar samples, suggest the following: (1) soil samples, breccias, metaclastic rocks, and feldspathic basalts represent mixtures of repeatedly-modified clastic material, which was ultimately derived from materials formed during the about 4.6 AE differentiation; and (2) mare basalts crystallized from melts which formed by partial melting and, which developed without equilibration between the melt and crystalline residuum. Author

N75-16440*# Colorado Univ., Boulder. Dept. of Astro-Geophysics.
ANALSYIS OF DATA FROM SATELLITE EXPERIMENTS Final Report, 1 Sep. 1973 - 1 Jul. 1974
Gary E. Thomas 1 Jul. 1974 10 p refs
(Grant NGR-06-003-201)
(NASA-CR-142057) Avail: NTIS HC $3.25 CSCL 03B

Identical ultraviolet photometer experiments were carried on the eccentric ojbiting OGO-5 spacecraft and on the polar orbiting OGO-6 spacecraft. The experiments operated flawlessly and, due to sophisticated electronic design, allowed signals to be processed accurately over a large dynamic range. Scientific results gained from the post-mission data analysis efforts are summarized.
Author

N75-16441*# Texas A&M Research Foundation, College Station. Dept. of Physics.
THE CLOUDS OF VENUS
Andrew T. Young 31 Jan. 1975 28 p refs
(Grant NGR-44-001-117)
(NASA-CR-142056; Rept-16) Avail: NTIS HC $3.75 CSCL 03B

The physical and chemical properties of the clouds of Venus are reviewed, with special emphasis on data that are related to cloud dynamics. None of the currently-popular interpretations of cloud phenomena on Venus is consistent with all the data. Either a considerable fraction of the observational evidence is faulty or has been misinterpreted, or the clouds of Venus are much more complex than the current simplistic models. Several lines of attack are suggested to resolve some of the contradictions. A sound understanding of the clouds appears to be several years in the future. Author

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N75-16442* National Aeronautics and Space Administration, Washington, D.C.
THE JUPITER PIONEERS
[1974] 12 p Original contains color illustrations
(NF-50-8/74) Avail: SOD HC $0.60 CSCL 22C

The accomplishments of the Pioneer 10 space probe are described through artist concept drawing and concisely written documentation. Illustrations are provided of the following: (1) photography of planet Jupiter, (2) planet Jupiter magnetic fields, (3) Pioneer 10 configuration with emphasis on signal transmission capability, (4) analysis of the Pioneer 10 trajectory, (5) the characteristics of planet Jupiter and the orbiting moons, and (6) a cross-sectional respresentation of the composition of the planet Jupiter. The plaque which is carried by the Pioneer 10 to indicate earth civilization by astronomical symbols, binary numbers, and drawings is shown. P.N.F.

N75-16443*# Carnegie Institution of Washington, D.C. Geophysical Lab.
PETROLOGICAL STUDIES ON LUNAR ROCK SAMPLES Final Technical Report, 1 Feb. 1972 - 1 Sep. 1974
Ikuo Kushiro 1 Sep. 1974 14 p refs
(Grant NGR-09-140-017)
(NASA-CR-141956) Avail: NTIS HC $3.25 CSCL 03B

Petrological studies were made on Apollo 14, 15, 16, and 17 lunar samples. High-pressure melting experiments were conducted, along with electron microprobe analyses. The compbsition of the samples is reported. N.E.R.

N75-16444*# Martin Marietta Corp., Denver, Colo.
VIDEO GUIDANCE, LANDING, AND IMAGING SYSTEM (VGLIS) FOR SPACE MISSIONS Final Report
Roger T. Schappell, Robert L. Knickerbocker, John C. Tietz, Christopher Grant, and John C. Flemming Feb. 1975 69 p refs
(Contract NAS1-13558)
(NASA-CR-132574) Avail: NTIS HC $4.25 CSCL 14B

The feasibility of an autonomous video guidance system that is capable of observing a planetary surface during terminal descent and selecting the most acceptable landing site was demonstrated. The system was breadboarded and 'flown' on a physical simulator consisting of a control panel and monitor, a dynamic simulator, and a PDP-9 computer. The breadboard VGLIS consisted of an image dissector camera and the appropriate processing logic. Results are reported. Author

N75-16445*# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.
PRECISION SELENODESY AND LUNAR LIBRATION THROUGH VLBI OBSERVATIONS OF ALSEPs Final Technical Report, 1 Jan. 1974 - 31 Jan. 1975
Charles C. Counselman, III 31 Jan. 1975 34 p refs
(Grant NsG-7010)
(NASA-CR-142014) Avail: NTIS HC $3.75 CSCL 03B

Data from 500 observation series, each one representing about five hours' continuous observation of a pair of ALSEPs by differential very long baseline interferometers (VLBI) have been compiled on magnetic tape. The theoretical models used to calculate the rotation of the earth, the orbit of the moon, the libration of the moon, and the basic VLBI observable were improved substantially. Analysis of data from long spans of VLBI observations was begun. Author

N75-16446# Committee on Science and Astronautics (U. S. House).
VIKING PROJECT
Washington GPO 1974 301 p refs Hearings before Subcomm. on Space Sci. and Appl. of Comm. on Sci. and Astronaut. 93d Congr., 2d Sess., No. 51, 21-22 Nov. 1974 Nov. 1974
(GPO-44-128) Avail: Subcomm. on Space Sci.

A Congressional hearing was conducted to examine the NASA request for additional funds to be applied to the Lunar and Planetary Exploration program. The increase in the program is necessary to provide for unanticipated growth in funding requirements for the Viking project caused by development problems in a number of systems and subsystems. The authorized and planned actions on the FY 1974 program are tabulated to show the itemized expenditures. The objectives and operations bf the Viking program are described. The technical problems involved in the project are reported. The rationale for the increased expenditures is presented by selected witnesses from NASA. P.N.F.

N75-16447# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.
ANALYSIS OF LUNAR LASER AND ALSEP VLBI DATA FOR GEODETIC PURPOSES Final Report, 1 Sep. 1973 - 1 Jul. 1974
Irwin I. Shapiro and Robert W. King 31 Jul. 1974 16 p refs
(Contjact F19628-74-C-0027; AF Proj. 8607)
(AD-787779; AFCRL-TR-74-0382) Avail: NTIS CSCL 08/5

The M.I.T. Planetary Ephemeris Program has been used to perform simulated least squares estimates of geodetic and other parameters relevant to the analysis of lunar laser ranging observations. These observations can produce improved estimates of (a) observing station locations, (b) variations in the diurnal rotation rate, (c) polar motion, and (d) the earth's gravitational constant. Since the laser data are highly sensitive to the lunar physical libration, differential very-long-baseline interferometry observations of the ALSEP transmitters have been processed to aid in the analysis of the laser data. Author (GRA)

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N75-16448# Observatoire de Paris (France).
SYNOPTIC CHARTS OF THE SOLAR CHROMOSPHERE AND CATALOGS OF FILAMENTS AND ACTIVITY CENTERS, VOLUME 5, PART 4, 1972 - 1973 [CARTES SYNOPTIQUES DE LA CHROMOSPHERE SOLAIRE ET CATALOGUES DES FILAMENTS ET DES CENTRES D'ACTIVITE, VOLUME 5, FASCICULE 4, 1972 - 1973]
1974 85 p In FRENCH
Avail: NTIS HC $4.75

Synoptic charts of chromospheric filaments and activity centers observed on the sun between December 31, 1972 at a beginning rotation of n deg 1583 and the January 5, 1974 at an end rotation of n deg 1609, are presented.
Transl. by E.H.W.

N75-16449# California Univ., Livermore. Lawrence Livermore Lab.
SOLAR RADIATION MODEL RAD1
F. M. Luther 7 Aug. 1974 13 p refs
(Contract W-7405-eng-48)
(UCID-16572) Avail: NTIS HC $3.25

The radiative transfer equation for a cloudless, plane-parallel atmosphere is solved using the successive-scattering iterative procedure of Dave and Gazdag in which the scattering phase function is expressed in a Fourier series. The model includes Rayleigh and Mie scattering along with absorption by aerosol, ozone, water vapor, carbon dioxide, and oxygen. The solar spectrum is divided into discrete spectral intervals (83 in the present model), and the vertical column is divided into up to 500 layers depending upon the optical thickness of the atmosphere. The direct solar flux and the upward and downward diffuse fluxes for each spectral interval at each level are computed taking into account all orders of scattering. Author (NSA)

N75-16450# Analysis and Computer Systems, Inc., Burlington, Mass.
SOLAR GEOPHYSICAL DATA PROCESSING SYSTEM Final Report, 1 Jul. 1973 - 30 Jun. 1974
John A. Fusco and Peter R. Hickey Jul. 1974 21 p
(Contract F19628-74-C-0006; AF Proj. 8666)
(AD-787778; AFCRL-TR-74-0376) Avail: NTIS CSCL 03/2

The Solar Geophysical Data Processing System is part of a Research and Development (R and D) effort performed at Air Force Cambridge Research Laboratories (AFCRL) in conjunction with the Air Weather Service (AWS). This R and D project is an effort to develop a system capable of processing data received on a daily basis from the Astrogeophysical Teletype Network (ATN). The Solar Geophysical Data Processing System consists of a series of programs designed for and implemented on the Air Force Global Weather Central (AFGWC) Univac 1108 computer system housed at Offutt Air Force Base, Omaha, Nebraska. The system processes the ATN data in real time, for a number of scientific disciplines including Solar Optics and Solar Radio.
Author (GRA)

N75-16451# Panametrics, Inc., Waltham, Mass.
SOLAR UV FLUXES AND OZONE OVERBURDENS OBTAINED FROM UVS MEASUREMENTS ON THE CIAP AIRSTREAM FLIGHT SERIES OF JUNE 1973, SEPTEMBER 1973, NOVEMBER 1973, AND JANUARY 1974 Annual Report, 1 Sep. 73 - 31 Aug. 74
Frederick A. Hanser and Bach Sellers Aug. 1974 68 p refs
Sponsored in part by DOT
(Contract N00014-73-C-0316)

An ultraviolet interference-filter spectrophotometer (UVS) has been used to obtain solar UV fluxes and ozone overburdens at high altitude from several flight series on a WB57F aircraft. The altitude from several flight series on a WB57F aircraft. The data from four DOT Climatic Impact Assessment Program (CIAP) Airstream flight series have been reduced to final UV flux and ozone overburden values and the results are presented in this report. A total of about 53-1/2 hours of usable data is given in tabular form. These data are of use for the interpretation of other measurements made on the same flight series, and for baseline measurements for future long term monitoring programs. Author (GRA)

N75-16425* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR AND TERRESTRIAL PHYSICS
In its Significant Accomplishments in Sci. and Technol. 1975 p 92-138 (For availability see N75-16422 07-88)
CSCL 03B

N75-16458* Kanner (Leo) Associates, Redwood City, Calif.
SOLAR ACTIVITY AND ITS RELATION TO CERTAIN PARAMETERS OF PHENOMENA IN THE GEOPHYSICAL COMPLEX
T. S. Razmadze and A. M. Chkhetiya *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 125-132 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 84-86 (For availability see N75-16452 07-93)
CSCL 03B

93 SPACE RADIATION

Includes cbsmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N75-16452*# Kanner (Leo) Associates, Redwood City, Calif.
COSMIC RAYS
S. N. Vernov, ed. and L. I. Dorman, ed. Washington NASA Jan. 1975 404 p refs Transl. into ENGLISH of the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 260 p
(Contract NASw-2481)
(NASA-TT-F-807) Avail: NTIS HC $10.50 CSCL 04A

Theoretical and measurements problems of cosmic ray research are elaborated. For individual titles, see N75-16453 through N75-16499.

N75-16453* Kanner (Leo) Associates, Redwood City, Calif.
THEORY OF COSMIC RAY VARIATIONS
L. I. Dorman *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 1-101 Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 5-64 (For availability see N75-16452 07-93)
CSCL 04A

The initial anisotropic and isotropic spaces of solar cosmis ray spreading in interplanetary space are compared with the results of direct observations in the region adjacent to the earth's orbit and with the results of explorations of the eleven-year and twenty-seven-day variations of the cosmic rays in more distant regions. Author

N75-16454* Kanner (Leo) Associates, Redwood City, Calif.
ENERGY SPECTRUM OF GALACTIC ELECTRONS IN THE ENERGY RANGE 2 X 10 TO THE 10 POWER - 2 X 10 TO THE 11th POWER eV
V. I. Zatsepin, V. I. Rubstov, and N. S. Svirzhevskiy *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 102-105 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 67-68 (For availability see N75-16452 07-93)
CSCL 04A

New experimental data on the energy spectrum of galactic electrons up to the energies approximately 2 x 10 to the 11th power eV were obtained in the summer of 1967 by a scintillation telescope lifted to the stratosphere at 32 km. The geometrical factor of the telescope was 1200 sq cm steradians, i.e., three times as great as the geometrical factor of previously employed installations. The results confirm previous measurements. Author

N75-16455* Kanner (Leo) Associates, Redwood City, Calif.
THE RELATION BETWEEN THE CHEMICAL COMPOSITION OF SOLAR COSMIC RAYS AND THE DURATION SPECTRUM OF RADIOSPLASHES
N. P. Tsimakhovich *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 106-111 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 69-72 (For availability see N75-16452 07-93)
CSCL 04A

The comparison of durations of the centimeter and meter components of the radiosplashes corresponding to the chromospheric flares with the known chemical composition of the radiated nuclei has shown a greater duration of the centimeter component for the splashes wherein protons are dominating, and vice versa. A conclusion is made about the interrelation of heavy nucleus emission and the processes which occur in the upper layers of the solar corona. Author

N75-16456* Kanner (Leo) Associates, Redwood City, Calif.
SOLAR ACTIVITY AND COSMIC RAYS IN THE PERIOD 1963-1965
A. G. Zusmanovich, Ye. V. Kolomeyets, R. A. Chumbalova, and Yu. A. Shakhova *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 112-119 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 73-77 (For availability see N75-16452 07-93)
CSCL 04A

The interrelation between the intensity of cosmic rays and various indices of solar activity during January 1963 to June 1965 is studied. Author

N75-16457* Kanner (Leo) Associates, Redwood City, Calif.
THE COSMIC RAY BURST ON 28 JANUARY 1967
N. P. Chirkov, G. F. Krymskiy, I. S. Samsonov, and V. I. Ipatev *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 120-124 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 78-80 (For availability see N75-16452 07-93)
CSCL 04A

The solar cosmic ray flare which took place on January 28, 1967, is analyzed. Energy responses and the diffusion coefficient are determined. Periodic variations of the cosmic rays with an amplitude of 0.10 to 0.20% and a period of 35 to 40 min are discovered during the decrease phase of the flare. Author

N75-16458* Kanner (Leo) Associates, Redwood City, Calif.
SOLAR ACTIVITY AND ITS RELATION TO CERTAIN PARAMETERS OF PHENOMENA IN THE GEOPHYSICAL COMPLEX c92
T. S. Razmadze and A. M. Chkhetiya *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 125-132 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 84-86 (For availability see N75-16452 07-93)
CSCL 03B

Results of a detailed analysis of solar activity in 1957-1965 are compared with the data on solar activity with variations of cosmic ray activity, and geomagnetic, ionospheric and terrestrial currents. Cosmic ray variations are investigated with reference to the asymmetry of solar hemispheres. All storms in the IGY are classified and a symbolic diagram of the time sequence is drawn up. Author

N75-16459* Kanner (Leo) Associates, Redwood City, Calif.
ATMOSPHERIC EFFECTS AND SIDEREAL-DIURNAL VARIATIONS IN EXTENDED AIR SHOWERS c46
N. N. Efimov, D. D. Krasilnikov, S. N. Nikolskiy, and F. K. Shamsutdinova *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 133-137 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 87-90 (For availability see N75-16452 07-93)

CSCL 04A

Observations are presented on the variations of extended air shower intensity with an average power of 1.4 x 10,000 and 1.4 x 100,000 particles at sea level. The effect of disintegrating particles and the essential role of cascades formed above the lower third of the atmosphere are examined. However, the authors failed to discover anisotropy of initial particles with an energy of 10 to the 14th power to 10 to the 15th power eV with an accuracy of up to 0.1%. Author

N75-16460* Kanner (Leo) Associates, Redwood City, Calif.
COMPARISON OF THE RESULTS OF SIMULTANEOUS COSMIC RAY MEASUREMENTS IN THE STRATOSPHERE AT THE OLENIA AND APATITY STATIONS
L. L. Lazutin *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 138-141 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 91-92 (For availability see N75-16452 07-93)
CSCL 04A

The results of regular measurements of the cosmic ray intensity in the stratosphere obtained by high latitudinal stations during September-December 1966 are compared. The present paper estimates the agreement between the results obtained by closely located stations by means of various radiosondes. The assumption about the substantial contribution of auroral X-ray radiation to the fluctuation of the radiosonde counting rate at high altitudes is confirmed. Author

N75-16461* Kanner (Leo) Associates, Redwood City, Calif.
ALTITUDINAL, DIURNAL AND LATITUDINAL DEPENDENCES FOR IONIC CONCENTRATIONS FORMED BY CORPUSCULAR FLUXES IN THE STRATOSPHERE AND MESOSPHERE c46
Yu. A. Bragin *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 142-144 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 93-94 (For availability see N75-16452 07-93)
CSCL 04A

On the basis of over 15 rocket measurements of ionic concentrations below 80 km, the height, daily and latitudinal dependences between positive ionic concentrations and cosmic ray intensity below 60 km as well as between ionic concentrations and corpuscular streams within the 60-80 km altitude range are compared. It is shown that ionic concentration and cosmic ray intensity below 60 km at night are likely to be interrelated, in conformity with Chapman's theory of the simple layer. In daytime, all phenomena are aggravated by photodetachment and ion exchange reactions with the participation of ozone. Between 60-80 km, besides ordinary cosmic rays, there must exist an additional corpuscular stream. Author

N75-16462* Kanner (Leo) Associates, Redwood City, Calif.
THE EFFECT OF COSMIC RAYS ON THUNDERSTORM ELECTRICITY c46
Yu. A. Bragin *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 145-147 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 95 (For availability see N75-16452 07-93)
CSCL 04A

The inflow of charges of small ions, formed by cosmic rays, into thunderstorm cells is estimated on the basis of rocket measurements of ionic concentrations below 90 km. Out of the two processes that form the thunderstorm charge (generation and separation of charges), the former is supposed to be caused by cosmic rays, and the nature of separation is assumed to be the same as in other thunderstorm theories. Author

N75-16463* Kanner (Leo) Associates, Redwood City, Calif.
POSSIBILITY OF CONTROLLING THE EARTH'S NEGATIVE CHARGE AND THE UNITARY VARIATION OF ITS ELECTRIC FIELD BY COSMIC RAYS c46
Yu. A. Bragin, S. S. Vorontsov, and A. A. Kocheyev *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 148-153 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 96-97 (For availability see N75-16452 07-93)
CSCL 08N

The dependence of the atmospheric conductivity upon the cosmic ray intensity, the possibility of charge generation in thunderstorxs by cosmic rays, the dependence of the troposphere electricity on the stratosphere, the relationship between the unitary variation of the earth's electric field intensity and that of cosmic ray intensity (daily, yearly and 11-year latitudinal dependence of both values), deny first, the exceptional role of the tropospheric processes in maintaining the terrestrial charge and unitary variation, and, second, compel one to consider the cause mentioned above to be the result of the influence of cosmic rays. Author

N75-16464* Kanner (Leo) Associates, Redwood City, Calif.
EFFECT OF THRESHOLD RIGIDITY VARIATIONS ON THE ELECTRON PRODUCTION RATE IN THE ATMOSPHERE c46
L. I. Dorman, T. M. Krupitskaya, and M. I. Tyasto *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 154-158 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 99-101 (For availability see N75-16452 07-93)
CSCL 04A

Current systems formed during magnetic disturbances cause threshold energy variations of cosmic ray particles. The latter, in turn, are a source of electron production in the terrestrial atmosphere. The paper gives the calculations of the electron production rate with the count of threshold variations during magnetic disturbances. Author

N75-16465* Kanner (Leo) Associates, Redwood City, Calif.
SECULAR VARIATIONS OF L, B-COORDINATES c46
I. V. Getselev, E. V. Gorchakov, and V. A. Eltekov *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 159-163 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 102-104 (For availability see N75-16452 07-93)
CSCL 04A

The calculation results of L, B-coordinates for different years from 1957 to 1967 are given. Periodic calculations of the geomagnetic coordinates for different epochs are considered to be very urgent. Author

N75-16466* Kanner (Leo) Associates, Redwood City, Calif.
POSSIBLE ISOTOPIC SHIFTS WITH CHANGES IN THE GEOMAGNETIC FIELD c46
Yu. P. Bulashevich, V. M. Yershov, and V. F. Zakharchenko *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 164-169 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 105-107 (For availability see N75-16452 07-93)
CSCL 04A

The geomagnetic fields of the past geological epochs are studied on the basis of observations on the rock residual magnetization. This paper evaluates the shifts in the isotopic composition of the same elements in the rocks affected by cosmic rays. The possibility of using the shifts in the isotopic composition for revealing geomagnetic field inversions is discussed. Geomagnetic field inversion periods traced by the rock residual magnetization are in good agreement with the periods of the greatest qualitative changes in the animal world throughout the last 500 million years. Author

N75-16467* Kanner (Leo) Associates, Redwood City, Calif.
CALCULATIONS OF THE COSMIC RAY MODULATION IN INTERPLANETARY SPACE TAKING INTO ACCOUNT THE POSSIBLE DEPENDENCE OF THE TRANSPORT TRAVEL FOR THE SCATTERING OF THE PARTICLES AND OF THE VELOCITY OF THE SOLAR WINDS ON THE ANGLES THEY MAKE WITH THE HELIOEQUATOR PLANE: THE CASE OF ISOTROPIC DIFFUSION
L. I. Dorman and Z. Kobilinski *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 170-205 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 109-134 (For availability see N75-16452 07-93)
CSCL 03B

The modulation of galactic cosmic rays is studied by the magnetic heterogeneities stream on the assumption that the diffusion coefficient is reduced whereas the solar wind velocity

is increased with the growth of the angle between the sun's rotation axis and the direction of solar plasma motion. The stationary plane problem of isotropic diffusion is solved as it applies to two cases: (1) with due account of particle retardation by the antiphermium mechanism; and (2) without an account of the above mechanism. This problem is solved by the grid method in the polar coordinate system. The results of the calculations are followed by a discussion of the method of solution and of the errors. Author

N75-16468* Kanner (Leo) Associates, Redwood City, Calif.
A STUDY OF COSMIC RAYS ON THE ARTIFICIAL MOON SATELLITES LUNA-11 AND LUNA-12
N. L. Grigorov, V. G. Kurt, V. N. Lutsenko, V. L. Maduyev, N. F. Pisarenko, and I. A. Savenko *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 206-226 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 135-148 (For availability see N75-16452 07-93)
CSCL 03B

In the period from the end of August 1966 to January 1967 the primary cosmic radiation fluxes beyond the terrestrial magnetosphere were measured by means of the equipment mounted on the satellites Luna-11 and Luna-12. The altitude dependence of cosmic rays near the lunar surface as well as the intensity of protons and electrons of solar origin in the moon's vicinity were determined. The correlation of proton intensity with the parameters characterizing the solar and geomagnetic activities and the specific features of the angular distribution of the proton flux as revealed during measurements are given. Data on electron fluxes studied on September 1 and 8, 1966, when short term increases in the electron intensity were observed are included. Author

N75-16469* Kanner (Leo) Associates, Redwood City, Calif.
THE STUDY OF COSMIC RAYS ON THE PROTON ARTIFICIAL EARTH SATELLITE
N. L. Grigorov, I. A. Savenko, R. N. Basilova, N. N. Volodichev, S. I. Voropayev, L. F. Kalinkin, G. P. Kakhidze, V. A. Labutin, A. S. Melioranskiy, E. A. Pryakhin et al *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 227-246 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 149-160 (For availability see N75-16452 07-93)
CSCL 03B

Investigations were carried out with the space stations of the Proton series to study the physics of cosmic rays. The SEZ-13 device for the search of particles with a fractional electrical charge and the SEZ-11 device for the measurement of high energy electrons were mounted on the Proton-3 satellite. The mode of action of the SEZ-11 device differed from that of the SEZ-12 device used in the Proton-1 and Proton-2 satellites for similar purposes. Some of the results that were obtained are presented. Author

N75-16470* Kanner (Leo) Associates, Redwood City, Calif.
MEASUREMENT OF PROTON SPECTRA ON SATELLITES FROM THE COSMOS SERIES OF ARTIFICIAL SATELLITES
Ye. Ye. Kovalev, V. I. Ostroumov, S. S. Skvortsov, and L. T. Smirennyy *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 247-251 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 161-164 (For availability see N75-16452 07-93)
CSCL 03B

In 1966-1967 measurements were performed at altitudes from 200 to 400 km to determine the fluxes and spectra of protons by means of nuclear emulsions of the BR-2 and Ya-2 types. The proton spectra within the range up to 8 BeV are presented. The spectra obtained are the basis for estimating radiation hazards. Author

N75-16471* Kanner (Leo) Associates, Redwood City, Calif.
MEASUREMENT OF SPECTRA AND NEUTRON FLUXES ON ARTIFICIAL EARTH SATELLITES FROM THE COSMOS SERIES
V. Ye. Dudkin, Ye. Ye. Kovalev, M. R. Novikova, Yu. V. Potapov, S. S. Skvortsov, and L. N. Smirennyy *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 252-255 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 165-166 (For availability see N75-16452 07-93)
CSCL 03B

In 1966-1967 measurements were carried out at the altitudes of 200 to 400 km to determine the spectra and fluxes of fast neutrons inside the hermetically sealed artificial earth satellites of the Cosmos series. The detectors used were nuclear emulsions of the B9 and BR types and an emulsion of the P9 type, filled with Li and P. Spectra and fluxes of neutrons in the range of energies from thermal energies to 10 MeV are presented. Neutron doses are also estimated. Author

N75-16472* Kanner (Leo) Associates, Redwood City, Calif.
THE POSSIBILITY OF USING SUPERCONDUCTIVE SYSTEMS IN THE ANALYSIS OF THE COMPOSITION OF COSMIC RAYS
O. P. Anashkin, B. M. Belitskiy, V. B. Brodskiy, L. V. Kurnosova, N. N. Mikhaylov, L. A. Razorenov, L. A. Sidyakina, and M. I. Fradkin *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 256-260 Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 167-168 (For availability see N75-16452 07-93)
CSCL 14B

The experimental results on the use of superconductive systems onboard of spacecraft are described. To ensure low temperatures in the cryostat under weightlessness, helium was used at a pressure above the critical pressure. In flight, the temperature was controlled at six points, while the pressure and intensity of the magnetic field were controlled in the solenoids. The methodical test proved it possible to mount special installations on satellites, with extensive magnetic fields based on superconductive alloys, and particularly, low weights and low power consumption magnetic analyzers. Author

N75-16473* Kanner (Leo) Associates, Redwood City, Calif.
A STUDY OF THE INTERACTION OF NEUTRAL AND CHARGED PARTICLES c73
V. M. Kim *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 261-263 ref Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 169-170 (For availability see N75-16452 07-93)
CSCL 20H

Preliminary experimental data on the number of charged neutral nuclear-active particles were obtained at 200 BeV. The ratio of the number of charged particles to the number of neutral particles was 2.1 + or - 0.3. Nuclear cascade curves in iron and distributions over the portions of energy transferred to neutral pions in lead were obtained for avalanches generated by charged and neutral particles. The characteristics of interactions of the charged neutral particles at the existing experimental errors showed no difference. Author

N75-16474* Kanner (Leo) Associates, Redwood City, Calif.
MEASUREMENT OF THE RELATIVISTIC INCREASE IN PRIMARY IONIZATION FORMED BY A CHARGED PARTICLE IN A STREAMER CHAMBER c73
V. A. Davidenko, B. A. Dolgoshein, V. K. Semenov, and S. V. Somov *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 264-267 ref Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 171-173 (For availability see N75-16452 07-93)
CSCL 20H

The relative contribution of the secondary ionization to the measured ionization depending on the time of delay of the high-voltage pulse supply is estimated. Author

N75-16475* Kanner (Leo) Associates, Redwood City, Calif.
INSTALLATION FOR THE SEARCH OF HEAVY NON-RELATIVISTIC PARTICLES AT SEA LEVEL c73
A. M. Galper, V. A. Gomozov, A. F. Iyudin, Yu. D. Kotov, B. I. Luchkov, A. A. Prilepin, and A. I. Rogovskiy *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 268-271 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 174-176 (For availability see N75-16452 07-93)
CSCL 20H

A detector of heavy nonrelativistic sea level particles is described. Selection of events is based on the dependence of the qarticle path on particle mass at a given speed. Cerenkov counters with beta sub tr = 0.59 are used as speed selectors. Mounted above the detector is a scintillation counter for measuring the ionization caused by a particle. The particle track is recorded by spark chambers. Author

N75-16476* Kanner (Leo) Associates, Redwood City, Calif.
THE FEASIBILITY OF CONSTRUCTING A STABILIZING PLATFORM FOR A COSMIC RAY STATION c15
I. A. Akhmadeyev, V. M. Bednazhevskiy, and E. P. Tolpygin *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 272-278 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 177-180 (For availability see N75-16452 07-93)
CSCL 22B

One way of stabilizing a cosmic ray station on a space craft is the use of a three stage universal joint with a stabilization system consisting of three independent electrohydraulic drive mechanisms. Considered is the position of the cardan above the transverse axis of the spacecraft near the stern. Author

N75-16477* Kanner (Leo) Associates, Redwood City, Calif.
LARGE NEUTRON COUNTERS FOR SUPERMONITORS c35
Ya. L. Blokh, L. I. Dorman, V. K. Koiyava, V. Kh. Leonov, Kh. Narziev, and V. G. Chaykovskiy *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 279-281 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 181-182 (For availability see N75-16452 07-93)
CSCL 14B

Large neutron counters designed for the neutron supermonitor with an area of about 20 sq m are reported. Statistical accuracy of the counters is 0.1% per 2 hours. Dimensions: length--2 m; diameter--150 mm; pressure--200 mm Hg. The counters are filled with BF3 gas containing over 80% of B-10. Author

N75-16478* Kanner (Leo) Associates, Redwood City, Calif.
EFFECT OF ELECTRON DIVERGENCE IN AIR GAPS ON THE MEASUREMENT OF THE ENERGY OF CASCADES IN EMULSION CHAMBERS c73
A. V. Apanasenko, L. T. Baradzey, Ye. A. Kanevskaya, and Yu. A. Smorodin *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 282-286 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 183-185 (For availability see N75-16452 07-93)
CSCL 20H

The effect of an increase in electron density in the vicinity of the cascade axis caused by an avalanche passing through the gap between lead filters of the emulsion chamber was investigated experimentally. Optical densities were measured in three X-ray films spaced at 400, 800 and 1200 micrometer from the filter surface having a thickness of 6 cascade units. The optical densities of blackening spots caused by electron photon cascades of 1 to 2, 2 to 7 and greater than 7 BeV energies were measured. The results prove the presence of a gap between the filter and the nuclear emulsion which results in the underestimation of energy by several tenths of a percent. Author

N75-16479* Kanner (Leo) Associates, Redwood City, Calif.
DESCRIPTION OF AN IONIZATION CALORIMETER COMPLEMENTED WITH PROPORTIONAL COUNTERS c35
Kh. P. Babayan, N. G. Boyadzhyan, V. V. Vasiltsov, N. L. Grigorov, V. A. Sobinyakov, and V. Ya. Shestoperov *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 287-289 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 186 (For availability see N75-16452 07-93)
CSCL 14B

An ionization calorimeter is described with a system of proportional counters which are used to determine the charge of the particles incident to the calorimeter and to estimate the number of the secondary charged particles. Author

N75-16480* Kanner (Leo) Associates, Redwood City, Calif.
A DISCHARGE-CONDENSATION METHOD FOR THE DETECTION OF TRACES OF CHARGED PARTICLES c73
Z. Sh. Mandzhavidze and V. N. Roynishvili *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 290-292 Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 187-189 (For availability see N75-16452 07-93)
CSCL 20H

A new discharge condensation method is suggested for detecting the traces of charged particles. The chamber designed on the basis of this method possesses a high time resolution (several microseconds) and a greater memory time (dozens of milliseconds). Photographed traces of cosmic particles in the discharge condensation chamber are given. Author

N75-16481* Kanner (Leo) Associates, Redwood City, Calif.
A SYSTEM FOR MULTICHANNEL RECORDING AND AUTOMATIC READING OF INFORMATION c35
E. A. Bogomolov, Ye. Ya. Yevstafev, V. K. Karakadko, N. D. Lubyanaya, V. A. Romanov, M. G. Totubalina, and M. A. Yamshchikov *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 293-297 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 190-192 (For availability see N75-16452 07-93)
CSCL 14B

A system for the recording and processing of telescope data is considered for measurements of EW asymmetry. The information is recorded by 45 channels on a continuously moving 35-mm film. The dead time of the recorder is about 0.1 sec. A sorting electronic circuit is used to reduce the errors when the statistical time distribution of the pulses is recorded. The recorded information is read out by means of photoresistors. The phototransmitter signals are fed either to the mechanical recorder unit for preliminary processing, or to a logical circuit which controls the operation of the punching device. The punched tape is processed by an electronic computer. Author

N75-16482* Kanner (Leo) Associates, Redwood City, Calif.
INSTALLATION FOR THE STUDY OF THE ANGULAR DISTRIBUTION OF COSMIC MUONS WITH SUPER-HIGH ENERGIES AT LARGE ZENITH ANGLES c73
V. V. Borog, V. G. Kirillov-Ugryumov, A. A. Petrukhin, and V. V. Shestakov *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 298-301 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 193-194 (For availability see N75-16452 07-93)
CSCL 20H

An installation consisting of an ionization calorimeter and a counter hodoscope can be used to record cascade showers caused by the electromagnetic interactions of muons with superhigh energies in the cosmic ray horizontal flux. The direction of the muons is determined by a hodoscope consisting of 2196 counters. The information obtained makes it possible to restore the angular and energy distribution of the cosmic muons, which, in turn, makes it possible to determine the mechanism of their generation. The accuracy with which the angle of the passing particle is determined is discussed in detail in addition to the causes which can introduce distortions, such as shower accompaniment of neutrons, escape of shower electrons from the calorimeter, random coincidences, etc. Author

N75-16483* Kanner (Leo) Associates, Redwood City, Calif.
CERTAIN PROBLEMS IN THE DEVELOPMENT AND DESIGN OF SCINTILLATION AND CERENKOV COUNTERS c35
V. S. Chukin *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 302-307 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 195-198 (For availability see N75-16452 07-93)
CSCL 14B

The feasibility is examined of increasing the effectiveness of the scintillation and Cerenkov counters through improving light collection of the recorded radiation on the photoelectric cathode of the photomultiplier. An example of how to select a detector of the directional plexiglas Cerenkov counter is given. Also presented are experimentally obtained amplitude distributions during the recording of cosmic ray muons. The necessity to obtain agreement between the characteristic spectrum of the

photocathode of the photomultiplier and the spectrum of the recorded radiation is stressed. Author

N75-16484* Kanner (Leo) Associates, Redwood City, Calif.
STUDY OF SPARK CHAMBERS FILLED WITH VARIOUS GAS MIXTURES **c09**
G. S. Akopyan, N. Kh. Bostandzhyan, G. A. Marikyan, and K. A. Matevosyan *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 308-313 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 199-201 (For availability see N75-16452 07-93)
CSCL 14B

The performance is reported of the four layer spark chamber filled with alcohol vapors at 45 torr, very pure neon at 1 to 4.6 atm and also filled with only very pure neon at 1 to 2.9 atm. The curves of particles recording efficiency vs. the delay time in the chamber pulse supply and the number of operations are given. This efficiency decreases with an increase in the delay time; any addition of alcohol vapors increases the drop in the efficiency with time. However, alcohol vapors improve the localization of tracks along which the particles move and make them three to four times as narrow compared to the tracks inside the chamber filled with very pure neon. Author

N75-16485* Kanner (Leo) Associates, Redwood City, Calif.
A THREE-ELECTRODE STREAMER CHAMBER **c09**
N. N. Nurgozhin *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 314-320 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 202-204 (For availability see N75-16452 07-93)
CSCL 14B

A three electrode streamer chamber has been designed with basic components consisting of two glass boxes with overall dimensions 1.00 x 500 x 200 cu m filled with neon at 1 atm. Serving as a high voltage pulse source is a nanosecond voltage pulse generator with cutoff discharges at 16 atm nitrogen pressure. The discharges are designed for obtaining an adjustable pulse with an amplitude of 600 kV and a nanosecond pump. To match the chamber electrodes with the oscillator, the electrodes are manufactured in the shape of a three-wire strip line. The cutoff discharger plug-in and the operating instructions are also described here. Author

N75-16486* Kanner (Leo) Associates, Redwood City, Calif.
INCREASING THE ISOTROPIC PROPERTIES OF A DISCHARGE SPARK CHAMBER WITH A LARGE GAP **c09**
N. N. Nurgozhin *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 321-326 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 205-207 (For availability see N75-16452 07-93)
CSCL 14B

The recording of particle tracks in the form of sparks or streamers running at different angles toward the electric field of the chamber was studied. The investigations were performed with two discharge spark chambers consisting of boxes filled with neon at 1 atm. The spark chambers were powered by a pulse with an amplitude of 300 kV applied from a pulse generator. The recording of particle tracks in the form of sparks took place at track angles smaller than 30 deg with respect to the electrical field. At angle larger than 40 deg the tracks are recorded in the form of streamers. Particle traces with respect to the angle are given. Author

N75-16487* Kanner (Leo) Associates, Redwood City, Calif.
GAS THRESHOLD CERENKOV COUNTERS **c35**
V. I. Logachev, V. G. Sinitsyna, and V. S. Chukin *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 327-332 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 208-211 (For availability see N75-16452 07-93)
CSCL 14B

The report describes two designs are reported of gas threshold Cerenkov counters for recording electrons of primary cosmic rays without recording protons. Also presented are design and technological measures which ensure maximum light collection of the Cerenkov radiation originating on the photocathode of the photomultiplier inside the radiator. The dependence of the reflection factor on the length of the light wave for different coatings is shown as well as for the throughput of the different optical materials employed. A range of methods for determining the efficiency of the counters during the recording of cosmic ray muons and ways of increasing it further are given. Author

N75-16488* Kanner (Leo) Associates, Redwood City, Calif.
BACKGROUND ESTIMATION IN A (GNU e)-DIFFUSION DETECTOR **c73**
V. I. Glotov *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 333-336 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 212 (For availability see N75-16452 07-93)
CSCL 20H

Background conditions for detecting (gamma e)-diffusion are discussed with reference to the utilization of a hodoscope system consisting of wide area flat Geiger counters connected for coincidence and of a controllable spark chamber. When calculating the background, any organic compounds synthesized from C, O2 and H2 with radioactive admixtures is presumed to be the preferrable material for the construction of the detector. The number of background events simulating the effect sought is estimated by analyzing the spectrum of the organic glass gamma radiation caused by disintegration and fission of long lived isotopes and by nuclear reactions with the participation of alpha particles and neutrons. Author

N75-16489* Kanner (Leo) Associates, Redwood City, Calif.
COMPARATIVE ANALYSIS OF ERRORS IN DIFFERENT METHODS OF CALCULATING L, B-COORDINATES **c73**
I. V. Getselev, V. A. Eltekov, V. I. Volga, and V. A. Kuznetsov *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 337-340 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 213-215 (For availability see N75-16452 07-93)
CSCL 20H

Due to considerable difficulties of calculating L, B-coordinates, several simplified methods are currently used. The relative errors in L, B-coordinates calculated by approximate methods are given. It is suggested that different methods be used to calculate L, B-coordinates in the solution of various problems. Author

N75-16490* Kanner (Leo) Associates, Redwood City, Calif.
AN INSTRUMENT FOR THE STUDY OF THE COMPOSITION OF THE ELECTRON COMPONENT OF COSMIC RAYS **c35**
E. A. Bogomolov, V. K. Karakadko, N. D. Lubyanaya, V. A. Romanov, M. G. Totuvalina, and M. A. Yamshchikov *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 341-348 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 216-220 (For availability see N75-16452 07-93)
CSCL 14B

A telescope consisting of three spark chambers and two control scintillation counters has been designed and is used for investigating the composition of the cosmic ray electron component within the range of energies from 1.0 to 10.0 BeV by the EN assymetry method. The geometrical factor of the telescope is approximately 20 sq cm ster. Discharges are recorded in the chambers on a photo film. The telescope is oriented to the azimuth with an accuracy of + or - 3 deg. Author

N75-16491* Kanner (Leo) Associates, Redwood City, Calif.
SPARK CALORIMETER: AN INSTRUMENT FOR DETERMINING PARTICLE ENERGY OF COSMIC RADIATION **c35**
A. A. Alakoz, V. N. Bolotov, M. I. Devishev, L. P. Klimanova, and A. P. Shmeleva *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 349-354 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 221-223 (For availability see N75-16452 07-93)
CSCL 14B

In 1964 a spark calorimeter was installed at the NOR-Amberd Station (2000 m above sea level). The advantages of this calorimeter over the ionization calorimeter are illustrated. Author

N75-16492* Kanner (Leo) Associates, Redwood City, Calif.
GENERALIZATION OF FORMULAS FOR IONIZATION ENERGY LOSSES AND COLLISION CROSS SECTION IN THRESHOLD DETECTORS **c35**
V. K. Yermilova, L. P. Kotenko, G. I. Merzon, and V. A. Chekin *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 355-360 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 224-226 (For availability see N75-16452 07-93)
CSCL 14B

Two types of formulas were obtained for (- dE/dx) and the number of collisions per unit of path length (dN/dx) = const, which depend on W sub m, with due account of the polarization effect of the medium. Author

N75-16493* Kanner (Leo) Associates, Redwood City, Calif.
DISTORTION OF THE ALTITUDE DEPENDENCE AND ENERGY SPECTRUM OF THE NEUTRON COMPONENT NEAR THE EARTH'S SURFACE
G. V. Gorshkov and O. S. Tsvetkov *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 361-365 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13' Moscow, Nauka Press, 1972 p 227-228 (For availability see N75-16452 07-93)
CSCL 04A

The results of the altitude distribution of slow (cadmium difference) and fast (supercadmium) neutrons from 2000 m down to sea level are given. The neutron energy spectrum is calculated by the cadmium ratio. Author

N75-16494* Kanner (Leo) Associates, Redwood City, Calif.
THE EFFECT OF THERMAL NEUTRON FIELD SLAGGING CAUSED BY CYLINDRICAL BF3 COUNTERS IN DIFFUSION MEDIA **c73**
G. V. Gorshkov, O. S. Tsvetkov, and R. M. Yakovlev *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 366-371 ref Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 229-232 (For availability see N75-16452 07-93)
CSCL 20H

Computations are carried out in transport approximation (first collision method) for the attenuation of the field of thermal neutrons formed in counters of the CHM-8 and CHMO-5 type. The deflection of the thermal neutron field is also obtained near the counters and in the air (shade effect) and in various decelerating media (water, paraffin, plexiglas) for which the calculations are carried out on the basis of diffusion theory. To verify the calculations, the distribution of the density of the thermal neutrons at various distances from the counter in the water is measured. Author

N75-16495* Kanner (Leo) Associates, Redwood City, Calif.
STUDY OF COSMIC RAY MOTION IN COSMIC SPACE NEAR THE EARTH
V. K. Budilov, V. I. Ivanov, L. V. Kozak, L. A. Mirkin, and I. G. Tsukerman *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 372-379 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 233-235 (For availability see N75-16452 07-93)
CSCL 04A

Data are presented on experimental installations developed in the cosmic ray variations laboratory in Kazgu (Alma-Ata). Various experiments on modelling the interaction of plasma with tye geomagnetic field as well as the plasma distribution in quiet and disturbed fields are described. The characteristics of the meson supertelescope using scintillators (effective area, 10 sq m) for vertical alignments designed to study microvariations of the cosmic rays and their interrelation with magnetospheric fluctuations and the study of solar wind parameters are given. Author

N75-16496* Kanner (Leo) Associates, Redwood City, Calif.
DETERMINATION OF COUPLING COEFFICIENTS AT VARIOUS ZENITH ANGLES OF THE BASIS OF THE COSMIC RAY AZIMUTH EFFECT
S. A. Belskiy, B. A. Dmitriev, and A. M. Romanov *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 380-384 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 236-238 (For availability see N75-16452 07-93)
CSCL 04A

The value of EW asymmetry and coupling coefficients at different zenith angles were measured by means of a double coincidence crossed telescope which gives an opportunity to measure simultaneously the intensity of the cosmic ray hard component at zenith angles from 0 to 84 deg in opposite azimuths. The advantages of determining the coupling coefficients by the cosmic ray azimuth effect as compared to their measurement by the latitudinal effect are discussed. Author

N75-16497* Kanner (Leo) Associates, Redwood City, Calif.
MEASUREMENT OF SUPERSMALL QUANTITIES OF Ar37 AND H3 **c73**
G. E. Kocharovh and V. O. Naydenov *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 385-388 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 239-240 (For availability see N75-16452 07-93)
CSCL 20H

The results of measurements made on supersmall quantities of Ar-37 and H-3 by a low-background installation based on miniature proportional counters are presented. The article considers the sensitivity limit for the recording of Ar-37 and H-3. Author

N75-16498* Kanner (Leo) Associates, Redwood City, Calif.
PLASTIC SCINTILLATION COUNTERS WITH AN AREA OF 2 sq m **c35**
T. A. Yegorov, N. N. Yefimov, D. D. Krasilnikov, and I. Ye. Sleptsov *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 389-393 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 241-243 (For availability see N75-16452 07-93)
CSCL 14B

Two designs of plastic scintillation counters with an area of 2 sq m scanned in each case by a single photomultiplier of the FEU-49 type are described. The radial dependence of their light collection at the place of the path of the detected particle does not exceed 10% while the half width of the differential distribution of the pulse amplitudes from nonfiltered cosmic radiation at sea level is 90 to 95%, and 65%, the plastic thickness being 5 cm and 10 cm, respectively. The temperature coefficient of the counter is 0.32% per 1 C. Author

N75-16499* Kanner (Leo) Associates, Redwood City, Calif.
THEORY OF FLUCTUATIONS OF EXTENDED AIR SHOWERS
L. G. Dedenko *In its* Cosmic Rays (NASA-TT-F-807) Jan. 1975 p 394-397 refs Transl. into ENGLISH from the book "Kosmicheskiye Luchi, Sbornik Statey, No. 13" Moscow, Nauka Press, 1972 p 244-245 (For availability see N75-16452 07-93)
CSCL 04A

The Monte Carlo method was used to calculate the probability distribution functions of shower characteristics for primary protons at sea level. The calculation was based on the following model of the elementary event: the interaction paths are 90 g/sq cm for nucleons and 120 g/sq cm for pions. The nonelasticity coefficient for nucleons is uniformly distributed between 0.1 and 0.9, and for pions it is equal to 1. Isobaric pions are taken into account. The spectra of secondary particles were determined using Cocconi's approximation formula. The calculation for the nuclei was carried out on the assumption of a breakup of the nucleus into component nucleons. The mean number of particles and the variances of the distributions for electrons when the number of muons was fixed, and for muons when the number of electrons was fixed, were calculated. Author

99 GENERAL

N75-16500# Naval Undersea Center, San Diego, Calif.
REPORT OF THE AD HOC INTERLABORATORY COMMITTEE ON NAVY R AND D EMERGENCY ASSETS
Jul. 1974 45 p
(AD-787064; NUC-AP-5) Avail: NTIS CSCL 06/7

The results of ad hoc interlaboratory committee meetings conducted during October and December 1973 to determine how best to provide emergency assistance in case of a submarine/submersible disaster are reported. A plan to generate and maintain an Inventory of Navy Laboratory R and D Equipment Available for Emergency Undersea Operations is detailed. Reported are jecommended areas of rescue, search, inspection, salvage/recovery and surface support to be covered, target enhancement/equipment features, recommended new equipment, and available areas of expertise at Navy R and D Laboratories. Author (GRA)

N75-16501# RAND Corp., Santa Monica, Calif.
IMPROVING SAC AIRCREW AND AIRCRAFT SCHEDULING TO INCREASE RESOURCE EFFECTIVENESS Interim Report
Morton B. Berman Jul. 1974 131 p refs
(Contract F44620-73-C-0011)
(AD-787206; R-1435-PR) Avail: NTIS CSCL 15/5

Most short-horizon internal-resource allocations in the USAF are made through schedules. The report develops a methodology for estimating the potential gains in improving resource allocation and specifies approaches to attain the possible payoffs. Performance measures are identified that permit evaluation of the contribution of a schedule to total organizational performance. Schedules at a sample of SAC (Strategic Air Command) wings are evaluated. General specifications are made for man-machine systems to aid scheduling and additional research is outlined. (Modified author abstract) GRA

N75-16502# Naval Postgraduate School, Monterey, Calif.
MISSILE ALLOCATION MODELS FOR THE ATTACK OF DEFENDED TARGETS M.S. Thesis
Supachart Boonyachan Sep. 1974 53 p refs
(AD-787371) Avail: NTIS CSCL 15/7

The models presented here are for the allocation of missiles to defended targets with a fixed force of imperfect defense missiles. The attackers will be directed first at the defense sites then at the targets themselves. The imperfect defenders are used against the attackers on a one-for-one basis as long as defenders remain. If any attacker penetrates the defense site, all the defenders at that defense site are destroyed. The problems addressed are the offensive problems of determining how many attackers to send to each defense site and to the target complex. The necessary mathematical relationships are derived and used to obtain graphical results. Author (GRA)

N75-16503# Weapons Research Establishment, Salisbury (Australia).
[UNDERWATER AND SPACE RESEARCH, MISSILE TRIALS, AND ENGINEERING TECHNIQUES] Annual Report, 1973 - 1974
1974 67 p refs
(PB-235866/1) Avail: NTIS HC $4.25 CSCL 05B

Synopses of research and development activities are given in the following areas: underwater acoustics, infrared surveillance, space research, range facilities, research rockets, target drones, radar transmitters. GRA

N75-16283 Texas Instruments, Inc., Dallas.
THE ADVANCED SCIENTIFIC COMPUTER: AN ADVANCED COMPUTER ARCHITECTURE AND ITS REAL-TIME APPLICATION TO BALLISTIC MISSILE DEFENSE
John W. Blakemore *In* AGARD Real Time Computer Based Systems Dec. 1974 12 p (For availability see N75-16257 07-62)

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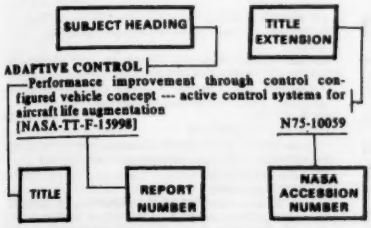

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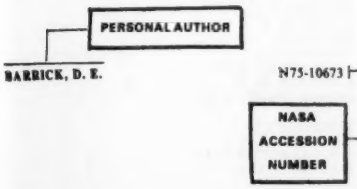

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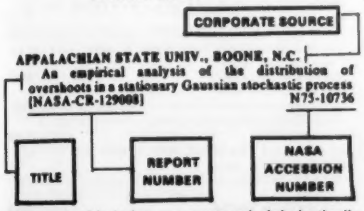

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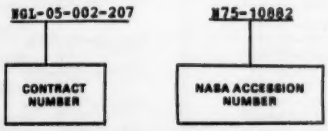

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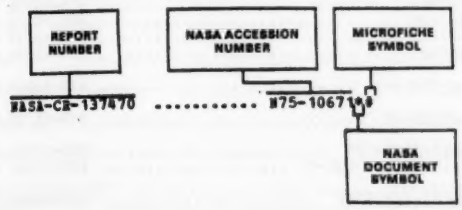

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COO-2081-17 ..... N75-16361 #
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COO-2155-12 ..... N75-16233 #
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DDA-EDR-8297 ..... N75-15619 #

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DNAAC-REP-PUB-74-003 ..... N75-16182 #

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DNA-3385F-1-VOL-1 ..... N75-16338 #
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ECOM-72-0158-F ..... N75-15967 #
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ERC-R-74010 ..... N75-16120 #

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ERIM-101900-46-L ..... N75-16031*#
ERIM-103300-42-L ..... N75-16038*#
ERIM-105100-8-F ..... N75-16404 #
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ESD-TR-74-241 ..... N75-15889 #

ESL-R-574 ..... N75-15626*#

ESRO-CR(P)-550 ..... N75-15727 #

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FA-R-2092 ..... N75-16343 #

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FTD-HC-23-945-74 ..... N75-15867 #

FTD-HC-23-1714-74 ..... N75-15798 #
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FTD-HT-23-1041-74 ..... N75-16372 #
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FTD-HT-23-1076-74 ..... N75-16368 #
FTD-HT-23-1344-74 ..... N75-15990 #

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LA-5584 ..... N75-15910 #
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LMSC-D384268 ..... N75-16085*#

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